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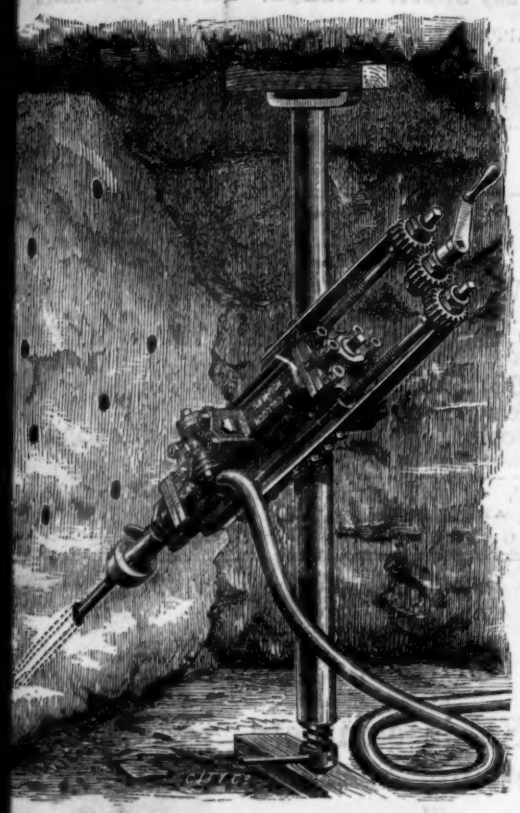

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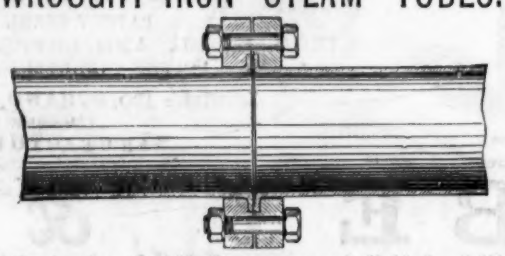

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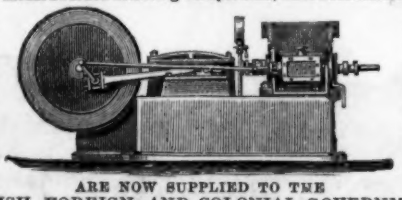

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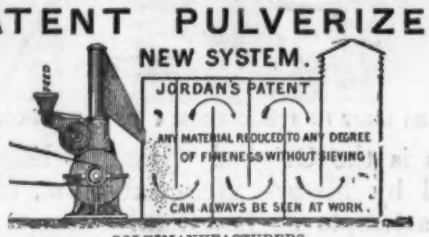

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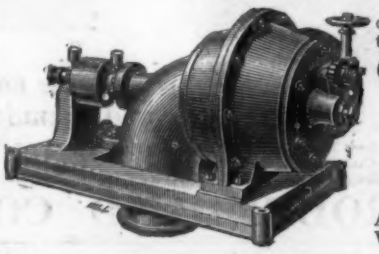

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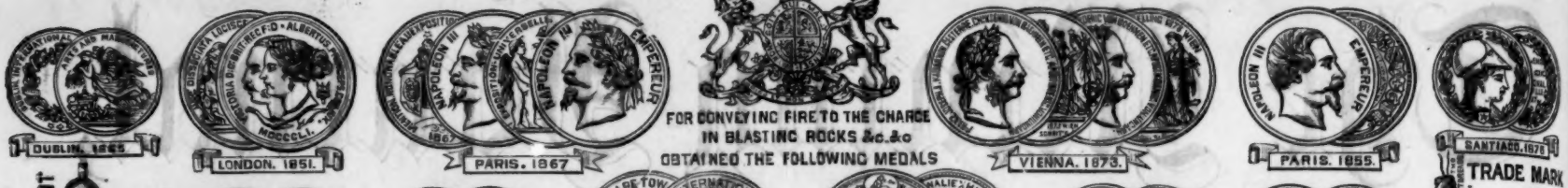

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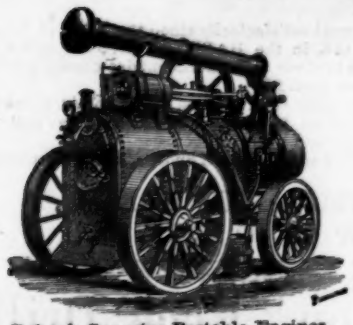

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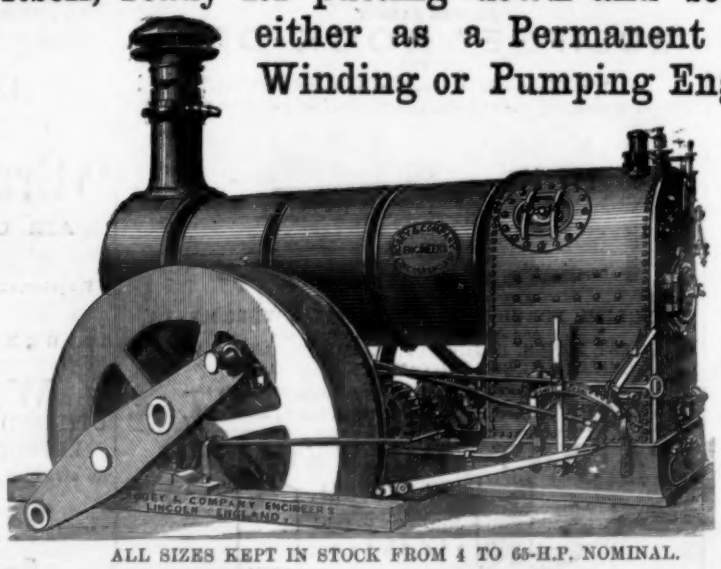

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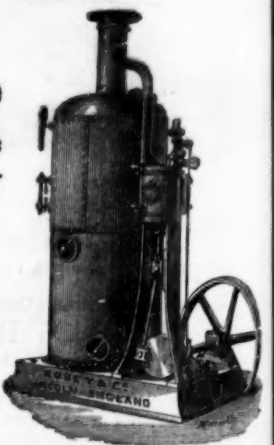

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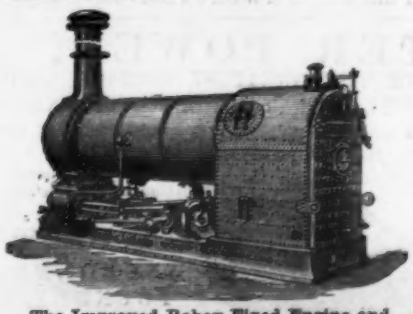

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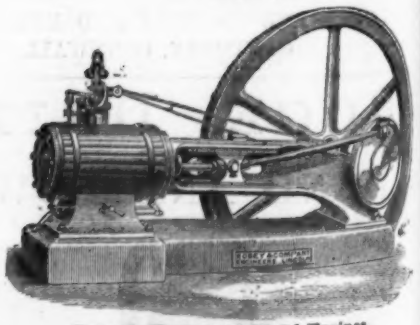

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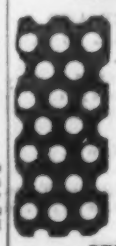

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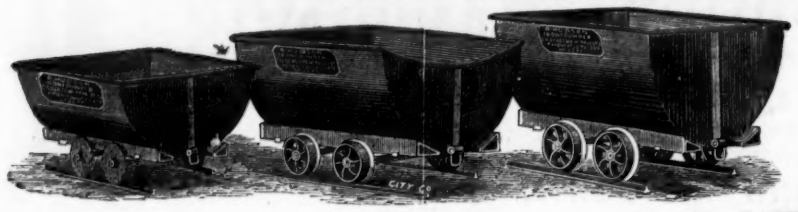

12.—PATENT STEEL HOPPER WAGON, WITH BOTTOM DOORS.

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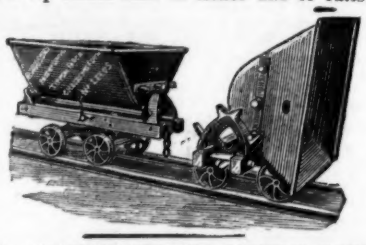
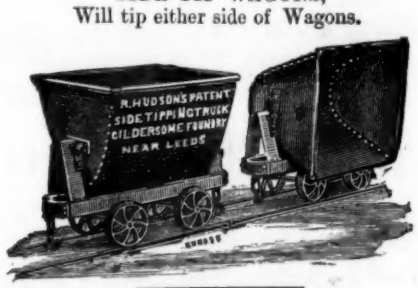
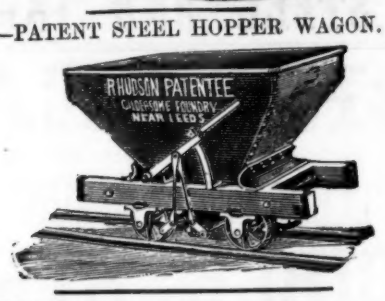


8.—PATENT DOUBLE-CENTRE STEEL SIDE TIP WAGONS,
Will tip either side of Wagons.

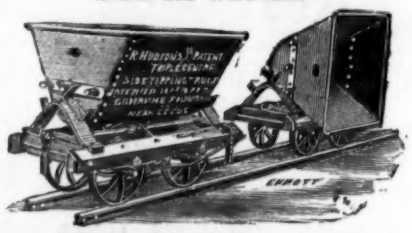


13.—PATENT STEEL HOPPER WAGON.



ONE man can EASILY tip ANY WEIGHT in these wagons.

3.—PATENT TRIPLE-CENTRE STEEL SIDE TIP WAGONS.



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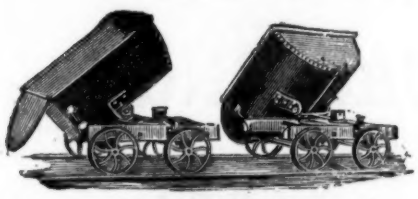
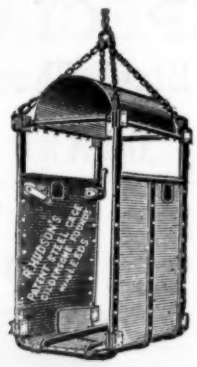
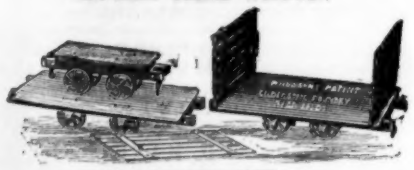


14.—SELF-RIGHTING STEEL TIP BUCKET.
(The "CATCH" can also be made SELF ACTING if desired.)

15.—STEEL CAGE.



4. PATENT STEEL PLATFORM OR SUGAR CANE WAGON.



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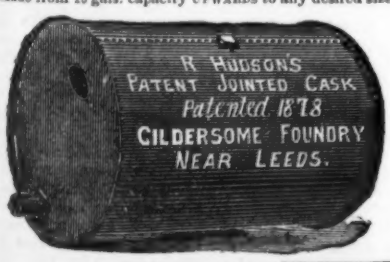
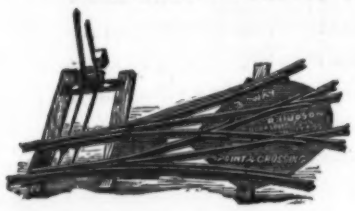


11.—RIGHT AND LEFT-HAND STEEL POINT AND CROSSING.



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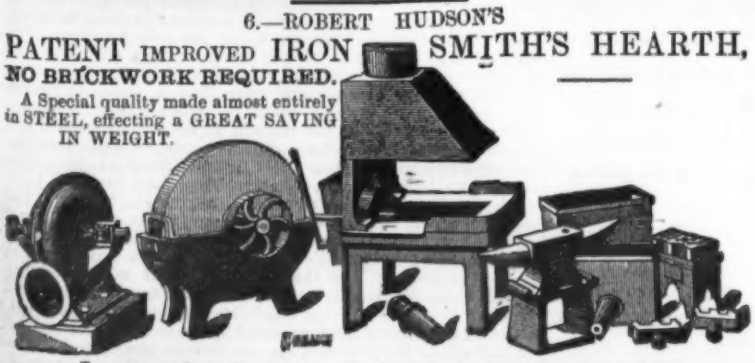

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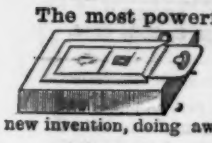
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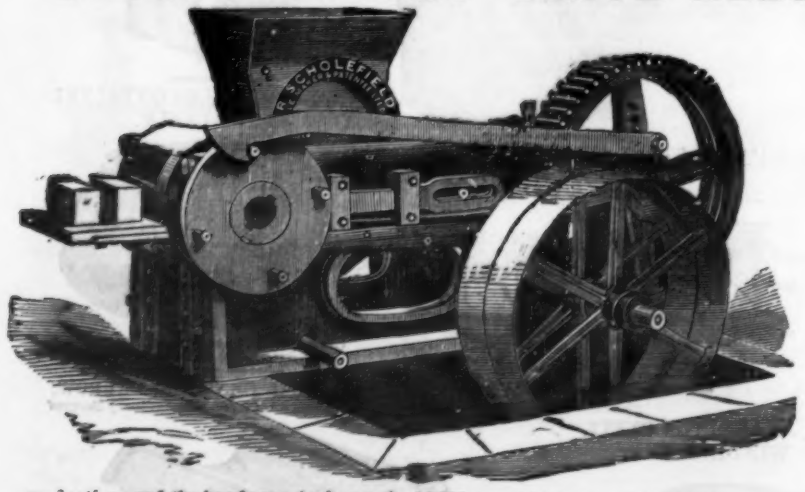

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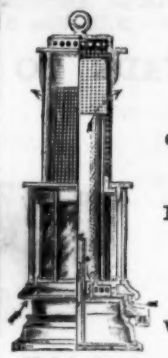

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"Herberton Advertiser" Office Herberton, September, 1882.

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TELEPHONING BETWEEN LONDON AND DOVER.—The Bell-Edison Telephone Company are constructing a line between London and Brighton which will be opened in a few weeks, and on Thursday the United Telephone Company demonstrated that telephonic communication between distant towns can be carried on with ease and reliability. To give evidence of the capability of the telephone for conveying speech from long distances, the directors invited a numerous party to witness the transmission of messages between Dover and London, along the telegraph wires of the London, Chatham, and Dover Railway, permitted by the Chairman of that Company, Mr. Forbes. The Telephone Companies are now permitted to lay their own trunk wires, and to make their own arrangements for way-leaves, to extend and ramify their connections with their exchange stations, and to forward telephone messages, convertible into telegrams from their various stations; in fact, to carry on their business as they please, under the sole condition of paying to the Post-office 10 per cent. royalty on their profits. As the telephone companies profess that the oral messages do not cost on the average more than a penny per message, the public may look to great convenience arising from the active enterprise which the removal of deterrent obstacles will no longer restrict. The first experiments made last night consisted of messages transmitted from the Grosvenor Hotel to Dover along a single wire brought to earth at both ends, and having in its route no less than nine block signal stations, the single needle instruments in which, and the other apparatus, being equal to over nine miles per station. These constituted a resistance of nearly 100 miles beyond that of the line wire, which was 78 miles long. The second experiment was the transmission of messages along a metallic circuit—that is, two wires coupled together, making 156 miles of wire, to which the block instruments added 200 miles resistance, making the total traversed by the messages the equivalent of 356 miles. Nevertheless the words were clearly and distinctly heard, so much so that one listening in the Grosvenor could instantly detect the errors of the operator in misquoted words in the nursery rhymes which he narrated for the edification of his London audience. The Chairman of the company, Mr. Brand, Mr. J. S. Forbes, and others were present, and general satisfaction was evinced.

Original Correspondence.

THE ALIANZA DE CICAPRA GOLD MINING COMPANY OF VENEZUELA.

WHY THIS COMPANY'S PROPERTY REMAINED UNDEVELOPED SINCE ITS INCORPORATION IN JULY, 1881, AND WHAT IS THE IMPEDIMENT TO ITS BEING MADE REMUNERATIVE?

A Synopsis of Reports by various Engineers who have inspected the Concessions of the Alianza de Cicapra Company. With Comments thereon and Suggestions. By THOMAS J. HAUGHTON, Mining Engineer and Assayer.

A printed circular, dated "Callao, Jan. 3, 1881, signed C. C. Fitzgerald," sets forth that a plot of land known as the "Cicapra Mining Property, comprising 1810 acres (since increased to 2542 acres by additional concessions) of surface, free from royalties or taxation, was available for purchase." The circular continues—"On organising the company it was our intention to develope the property and to work it as a permanent investment. Since the development of the rich and extensive lode styled Chimborazo the shares representing the enterprise have gradually increased in value, and many of the holders refuse 3000*l.* for each, while a few shares and coupons in the hands of speculators have lately been transferred at from 2000*l.* to 2500*l.* a share; consequently, I must say that a purchase of the entire property would not be effected at what we would call reasonable terms. Yet I will undertake to secure 54 shares of the 100 of the total issue on a basis of 5000*l.* per share." That is to say, Mr. Fitzgerald proposes to a company to purchase 54-100ths of a mining property for the sum of 270,000*l.* in shares and cash—a very nice sum for little more than half an undeveloped (in a practical view) mining property. Now, from a business point of view, What is this property which is valued at the modest sum of 500,000*l.* sterling? What has it yielded? How many thousand tons of ore have been reduced from it? And what has been the yield per ton, less the cost of production? In fact, to what extent has the property been developed? There is no record to show that so much as 100 tons of ore have been put through the mill—only that Mr. Fitzgerald ran the mill for nine days; but what the ore has yielded there is no evidence to show. With regard to the development, see Mr. Fitzgerald's report—"The lode is open (presumably the Chimborazo lode) and some 600 tons of quartz laid on the surface. The extent of the lode thus far opened is 1145 yards, with a thickness of talcose auriferous slate and quartz of about 17 ft. thick. The centre of the stratum containing the richest material is from 6 to 7 ft. in thickness." See the report of another engineer—"The Chimborazo, the most westerly and, in all probability, the richest and most important lode (about 6 ft. thick in its richest part), where no free gold is visible, 14 ozs. to the ton was obtained from a piece taken at random from a heap of 2000 tons lying at the pit mouth ready for treatment. Some specimens with no visible trace of sulphide gave, by assay, 2 ozs. to the ton. It is, therefore, not unreasonable to expect that from this lode the average yield would scarcely fall short of 4 ozs. to the ton." See another engineer's report—"The width of the lode averages about 3 ft., and the average probable yield 2½ ozs. per ton of raw material." The most impractical person naturally asks: What has become of the yield of this 2000 tons of ore to produce 4 ozs. per ton? 8000 ozs. of gold, worth in round numbers 30,000*l.* Why did not the manager continue getting this ore? It could not be exhausted, for, see one of the reports—"With regard to the quantity of ore available, taking a section of 500 yards only, there would be material sufficient at 100 tons per diem to last 20 years; as the lode has been explored on a length of upwards of 1000 yards with fair results, it may be considered as practically inexhaustible. It could not be for the want of funds to continue working, for the 30,000*l.* product from the 2000 tons would be sufficient to carry on the mine for six months even at Mr. Fitzgerald's estimate of $25,000 per month; and, with "an inexhaustible supply" of material, a 20-head battery and other appliances to reduce it already erected, why not continue getting this 4-oz. per ton stuff? To the impractical investor it is an enigma; to the practical gold miner it appears simply a farce, a travesty. Can any person concerned or interested in the property explain this apparently inexplicable mystery? Then what is the development Mr. Fitzgerald speaks of that so much enhances the value of this property? As far as can be gleaned from the various reports it consists of one shaft 160 ft. deep on the Chimborazo lode, which, according to one of the reports—"requires squaring, retimbering, and lining from top to bottom, including clearing and securing the walls of the underlay." From this shaft, presumably, the 2000 tons of ore were raised, see Mr. Fitzgerald—"A shaft has been sunk to a depth of about 160 ft. on the lode, and the lode has been tested with a diamond drill to the depth of 374 ft. The character of the lode continues very uniform. It is about 6 ft. thick in its richest part, but from wall to wall it is nearly 14 ft. thick, and gold has been found in the lode and wall over a thickness of 17 ft. The north and south prospecting on the lode comprises six or eight shafts, distributed over the line of the lode of 2250 metres, varying in depth from 20 ft. to 150 ft., one of which has been sunk to 60 ft. on the southern extension of the lode 2000 metres to the south of the main working shaft. The average produce may be safely estimated at from 8 to 10 ozs. per ton. There is an accumulation of over 2000 tons of ore ready for reduction at the mine, and the stoping ground is in condition for delivering from 40 to 50 tons per day to reduction works, while further developments of stopes, which must occur on starting the mill will open ground for delivery of any desired quantity per day.

Could anything be more enticing to the speculator than the knowledge of such a vast body of rich ore to yield 8 or 10 ozs. per ton with a 20-head battery and appliances erected ready for work, only requiring the confirmation that the 2000 tons already raised had been put through the mill and yielded 16,000 or 20,000 ozs. of the precious metal. Why did not the proprietors have it put through, and put the 70,000*l.* or 80,000*l.* that would accrue therefrom into their pockets? In fact, why did the proprietors desire to dispose of such a valuable property, which, according to Mr. Fitzgerald, would pay a dividend of 4½ per cent. monthly on a capital of $3,000,000?—54 per cent. per annum, truly a good investment! And why have a capital of $3,000,000 when half this amount would have more than sufficed? 100 shares of 3000*l.* each. One and a-half million dollars, and with 70,000*l.* worth of gold in the 2000 tons of ore awaiting reduction, and available to pay all possible working expense for six months? These are practical questions that require answering, and can be answered. Some will no doubt say only in one way, and this might be that the whole thing was exaggerated, and was in a great measure existing only in Mr. Fitzgerald's hallucinated judgment. On the Las Nievas lode several trial shafts have been sunk; 21 of them are 20 to 74 ft. deep, in every instance cutting the lode, which is between 5 and 6 ft. thick white quartz, and from which "several tons of material were sent to Callao, and passed through the mill with excellent results." But this material, about 57 tons, according to Mr. Fitzgerald, was "alluvium collected on surface at a depth of from 10 to 36 in.," and 6½ tons only was put through the mill at Callao, which yielded $8·96. "The sulphurets in the residue amount to about 3 per cent. of the gross weight, from which residue at least 10 ozs. per ton may be safely depended on, making this in all $15, or (say) ¾ oz. to the ton of alluvium." What a pleasure to a manager of a mine, endeavouring to pay dividends, to know he had a reserve of some thousands of tons of surface alluvium that would yield ¾ of an ounce per ton. I have put through a mill (and seen put through) thousands of tons of surface that only yielded 4 dwts. per ton and paid handsome dividends. Where is the record of all this 15 dwts. surface alluvium, or does it still remain? Again, could Mr. Fitzgerald expect any practical man to accept this and gulph it down? "At the present time on this location 150 to 200 men are at work under licenses of $1 a month for each location of their working (over 200 to 300 acres), producing 2000 to 3000 ozs. of gold per month by the use of the batea only." To put this paragraph into figures shows that the proprietors receive from the 200 men, alloting them five locations each, $1000 per month; 200 men to earn current rate of wages, $3 per day, $600, to work 30 days per month, $18,000. Take a medium of gold said to be obtained, 25,000 ozs. per month, at 3*l.* 15s. per ounce = $46,875; clear profit to the men $28,875, less the $1000 license fees paid to the proprietors. Would any manager of a mining property, after he became aware of the value of this alluvial deposit, be foolish enough to continue such a thing, or would he think the public gullible enough to credit it? Moreover, gold being not recuperative, these large areas of rich alluvial deposits that have been worked cannot be looked upon as assets; they only serve to show, as is generally the case where rich alluvial deposits have been found, there exists equally rich auriferous lodes that have fed the alluvium.

The La Cruz lode is the least developed. A prospecting shaft 6 ft. square, has been sunk about 70 ft., so as to cut the lode, which is 6 ft. in thickness, and other smaller prospecting pits have been dug on the lode. From all appearances, and from assays, it is believed to be a very extensive deposit, and that it will, under the most disadvantageous circumstances, pay at least 50 per cent. profit on the expense of working." From this the only conclusion to be drawn is that no ore from this lode has been put through the battery, and consequently have no knowledge as to its probable yield.

To summarise the whole concern, there are three lodes, from two of which no ore has been reduced at the mill, and they average (say) 6 ft. thick. It is not to be supposed for a moment that the gentlemen who have reported on this property would write the reports they have done without thoroughly prospecting these lodes, and being satisfied they contained gold more or less; and it is a very difficult thing, by prospecting the surface outcrop of a lode, to form an opinion as to what might be the probable yield per ton when it came to be reduced in the mill. Such being the case I will take it for granted these lodes will not yield ounces per ton, but say ½ oz., and go into figures of practical working cost, thereby ascertaining their monetary value at an estimate far below anything mentioned in any of the reports. They are reported to be white quartz, "resembling more the characteristics of the Callao;" the gold is free, and the lodes are 6 ft. Down to a depth of 100 ft. the ores from these lodes ought to be put on the bank at a cost of not more than 10s. per ton, if it is anything like ordinary working quartz (and paying at the rate of (say) 12 fr. per day for labour). A 40-head mill reducing 80 tons per day ought not to exceed 10s. per ton for ordinary free milling quartz, if fuel is obtainable at (say) 20s. per cord. Allow 2s. per ton for general expenses, including wear and tear, deterioration of property, expenses of head offices, &c.; total, 22s, 6d. per ton; allow an extra 2s. 6d. for margin and (say) 25s. per ton. Half an ounce of gold at (say) 3*l.* 15s. per ounce, 1*l.* 17s. 6d. clear profit; at half an ounce per ton, 12s. 6d., or 50*l.* per day, equal to $75,000 per year. The whole of the alluvium, according to the reports, I should class at the same value. My object in quoting these estimates of working expenses is to show what ought to be the actual working cost of such a mine as the Alianza de Cicapra is described to be in the reports. And, in proof of what I assert, there are mines now working in Australia, some of which I have been connected with, that pay a dividend on ore of 4 dwts. per ton, and have done so for years; the rate of labour being from 6s. 6d. to 7s. 6d. per day. Is it not a reasonable conclusion that when quartz mining is made a paying industry in Australia, yielding 4 dwts. to the ton, it ought to be remunerative in Guayana at 10 dwts. per ton, making every allowance for extra cost of labour, if worked legitimately and with economy. But the Chimborazo lode is the declared bonanza of the Alianza de Cicapra, opened on the surface for an extent of 1145 yards, a shaft sunk 160 ft. and proved by the diamond drill to a depth of 374 feet.

In the various reports written on this lode I cannot discover any mention at what depth the sulphurets first appear; unless it is an exceptional instance, there must be 50 ft. to 60 ft. of the ore from the surface downwards, in which the gold must be free, the atmospheric action generally penetrating to that depth (particularly in a slate country), and oxidising the pyrites. Except in cases where water is met with at a shallow depth, as a rule, sulphurets are not to any extent met with above the water level. If such be the case in the Chimborazo lode why not cut out all the free gold ore first? And if it yield (say) 1 oz. per ton the mine itself will have contributed 10 times the amount of capital necessary for its development (which can be progressing during the time the free ore is being worked), and also for extra appliances to treat the sulphurets. I would ask, is there any sense or reason for boring 300 or 400 ft. into the bowels of the earth to get gold when it is obtainable on the surface at half the cost. The art of working any mine is to endeavour, if possible, to make it pay for its own development. "But, it may be said by proprietors, we expect to get richer ore deeper down." Well, what if you do? and you are by no means certain of it. Why not wait with patience while the mine is paying, and not let it supply the funds wherewith to find this richer ore if it exists? Sinking and opening out levels costs money, to say nothing of the extra cost of working as the mine gets deeper, for pumping and winding machinery and extraction. This is the case at the present time with the Chimborazo lode. It is suggested to sink a new shaft to 250 ft. straight down, and the cost is estimated at 48*l.* per foot, including timbering. This is a tremendous price indeed, the country rock must be exceptionally hard, and timber very scarce, to entail a cost of 12,000*l.* for sinking a shaft of 250 ft. But I fail to see the necessity for sinking this shaft. Why not secure the old one and continue working from it, and, at the same time, sink an underlay shaft 12 ft. wide on the lode from the surface into the old straight one; erect the winding-engine at the top of the underlay, and lay rails down the incline for the trucks to be hauled up? By so doing a fourfold purpose is attained—1, the mine is thoroughly ventilated by carrying the underlay shaft down in three compartments, and stoping can be going on to supply the mill with ore as the sinking is continued; 2, by sinking on the lode the ore is thoroughly prospected, it being passed through the mill as obtained, and consequently its value known fully; 3, the ore obtained from the shaft while sinking helps to a considerable extent to pay the cost of the sinking; and 4, after breaking through into the old shaft the underlay can be continued to any depth required, consequently proving the lode fathom by fathom as it is sunk upon, and easily ventilating by means of a blower if required. But in a mine with a body of ore like the Alianza it is very improbable that such a thing as a blower would be required, as rock-borers would certainly be utilised, and the exhaust air from the boring machines would serve sufficiently to ventilate the mine. If at any future time it was found necessary to sink a straight shaft for the further development of the mine, then the proprietors would know they were expending their 12,000*l.* for a certainty, being already down probably the greater portion of the distance with the underlay and knowing the value of the lode at that depth. But to sink a straight shaft 250 ft. now at such an enormous cost would be folly, they or any person having not the slightest idea of what the lode would be worth when it was cut. Moreover, there is another advantage in sinking on the underlay. Every miner knows that it is always easier sinking on a lode formation than in the adjoining country rock, and a shaft sunk on the underlay, to answer the purpose of the 250 ft. straight, although having to go nearly three times the distance (750 ft.) would probably be sunk for half the money, would be more serviceable when it was sunk, proving the value of the lode the whole depth; and it would probably contribute one-fourth of the cost of sinking and timbering from the ore obtained from it. Economy must be studied if a mine is to be made to pay.

The sulphurets in the Chimborazo lode, from samples I have seen of them, I am satisfied are very rich, and the amounts of the various assays stated in the reports of the gentlemen who have visited the property certify the fact beyond doubt, and confirm my opinion; but I cannot say, judging by the samples I have seen, and experiments I have made, that I agree with them in regard to the mode of treatment they suggest to be adopted to extract the gold from these ores.

Chlorination seems to be the sole idea, and a desire to obtain, if possible, the whole of the gold contained in the ore should not go without calculating the cost—that is to say, whether it is worth while to pay 10*l.* to obtain 9*l.* worth of gold, or to pay 5*l.* to obtain 7*l.* worth from the same ore, the remaining 2*l.* worth going away in the tailings, being too unprofitable to extract. There is one great difficulty to contend with in working any chlorination process at the Alianza de Cicapra—the cost of transport of material necessary. It is stated in the report of of some of the gentlemen who have visited the property that carriage costs 20*l.* to 40*l.* per ton from Las Tablas. See one report—"From the port of Las Tablas to the mines, a distance of about 110 miles, the cost of transport varies from about 20*l.* to 60*l.* per ton. Most of the carriage already effected has cost, I understand, under 30*l.* The freight yet at La Tablas at the time of my passing there in August, amounting to about 110 tons, will undoubtedly cost considerably more—40*l.* per ton very probably."

Take (say) a medium cost of 27*l.* per ton from Las Tablas, and add the cost of freightage, insurance, wharf dues, commission, discharging and reloading of such commodities as common salt, chloride of lime, sulphuric and hydrochloric acids, &c. (all necessary in large quantities to work a chlorination process on an extensive scale) from the port of shipment either in the United States or Europe to Trinidad, from thence to be reshipped to Ciudad Bolivar, thence back again to Las Tablas, and the cost, by the time they arrive on the mine, will not be less at the lowest computation than 35*l.* per ton for carriage alone. Add to this the first cost of the articles, and the result will be, as shown in one of the reports, that to treat the sulphurets of the Alianza de Cicapra Mine by chlorination will cost from 4*l.* 5s. to 4*l.* 10s. per ton, and save 90 per cent. of the gold in the ore. This calculation, I am confident is under the mark, for I have known it to cost in Australia a similar price when the carriage for material was only 12*l.* per ton, and the rate of labour 10s. per day. Certainly the class of ore was more refractory than the Alianza samples I have seen, which would make the cost of the two about equivalent. Referring to a report by some of these gentlemen they state—"Our assays and working trials show that by the chlorination process (Plattner's) nearly the full amount of gold contained in the ore can be extracted, or at least 90 per cent., or (say) 2½ ozs. of fine gold per ton of raw material. Assuming that 30 tons of raw material can be worked every 24 hours, concentrated to 3½ tons, or (say) 700 tons per month, allowing for stoppages and delays, at 2½ ozs. would be 1750 ozs. of gold per month; and, as gold produced by chlorination is always over London standard of fineness, and is worth at least 26 pesos sencillos per oz., we have 700 tons at 2½ oz.,= 1750 ozs. gold, at 26 pesos sencillos, 45,500 sencillos, less total expenses, including superintendent's salary, supplies, wear and tear, &c., utmost 20,000 sencillos, would leave a profit per month of 25,500 sencillos."

If, not only in the interest of the proprietors of the Alianza de Cicapra Mine, but also for the benefit of all persons interested in gold mining in the State of Guayana; to assist in the promotion of the gold mining industry and the development of its vast resources, I can prove these refractory ores can be made more remunerative in a commercial point of view by not adopting the chlorination process to obtain 90 per cent. of the gold; but by treating those ores with mechanical appliances, I claim to have conferred a benefit on all concerned or interested in the industry. The main principle for making gold mining a successful industry is to obtain the greatest possible yield of gold from the ore at the least cost. Of what use is it to obtain gold at a cost of 5*l.* per oz. when its commercial value is only 4*l.*? What is the use of saving 90 per cent. of the gold in an ore, when a larger profit can be realised by saving only 75 per cent.? Gold mining is an industry that requires to be conducted on similar business principles as any other branch of commerce, and only by its being so conducted can it be made successful and remunerative. Of course there are exceptional instances like the El Callao, where the ore is so rich that it is not necessary to study economy, but such instances are very rare, and such yields cannot last for ever. With such mines after years of prolific expenditure when they come down to an ordinary yield it is a very difficult matter to pay expenses without a complete revolution in the system of working.

With regard to the Alianza de Cicapra ores I will undertake to save by mechanical appliances 75 per cent. of the gold contained in them, and I know other men who, like myself, have spent a lifetime at the business, who can do it also, and are doing it at this present time with equally refractory ores as the Alianza de Cicapra; practical men who have gained their knowledge at the battery (not by experimenting in laboratory), and who have had to manipulate ores yielding not 2½ ozs. per ton, but seldom over 1 oz., and requiring the greatest care and economy to make remunerative. The most impractical observer will see at a glance the pecuniary benefit accruing from mechanical appliances over chlorination—2½ ozs. of gold per ton obtained by chlorination saving 90 per cent. of the gross assay, costs 4*l.* 5s. per ton to obtain; 75 per cent. of the gross assay can be obtained by mechanical appliances from similar ore at 2*l.* 5s. per ton, that is 2 ozs. 2 dwts. of gold can be obtained by mechanical process at a cost of 2*l.* 5s. per ton, and 2 ozs. 10 dwts. by chlorination at a cost of 4*l.* 5s. per ton; by the latter process, paying 2*l.* for the extra 8 dwts., worth 32s., a dead loss of 8s. on every ton of ore treated. In comparison with the other estimate it figures:—

700 tons of ore at 2 ozs. 2 dwts per ton = 1470 ozs. at 26 pesos sencillos	38,220	pesos sencillos.
Total expenses of extraction at 2*l.* 5s. per ton, or (say) 14 sencillos	9,800	„
By mechanical appliances, profit per month	28,420	„
„ chlorination process	25,500	„
Profit by saving 75 per cent., instead of 90 per cent., or about 460*l.* per month, or...	2,920	sencillos.

And, working low grade ores, the profit would be, comparatively and considerably, much greater.

Persons interested in the gold mining industry, as a legitimate investment for capital, will do well to consider what I have herein stated. The Indian gold mines are labouring under the same difficulty, declared by the public as valueless, and, even stigmatised as swindles, through having been represented in glowing prospectuses and reports to yield immense profits by people who are incapable of working a mine, or have no practical knowledge of how to treat the products. When enormous capital has been spent and the promised dividends are not forthcoming, the result is, that investors look upon mining ventures with distrust, and decline to invest in them. At the present time, were it not for the indefatigable energy and perseverance of Capt. Plummer, of the Mysore Gold Mine, who stamps his practicability by the gold he remits from his battery, and by the confidence of the earnest board of directors he represents, Indian gold mines would have been, ere this, a thing of the past. And yet it is more than probable that several of the closed-down Indian mines are more valuable than the Mysore, if only worked with similar practical knowledge and energy.

To those interested and concerned in the welfare and development of the vast mineral resources of the Republic of Venezuela (which are accredited with being among the richest in the world) I would simply say that, if what I have herein set forth is doubted or discredited, I am prepared to prove it practically to any company that may desire it.

I may, perhaps, be permitted to record my own impression as to the causes which have prevented hitherto the development of the splendid property of the Alianza de Cicapra Company. So far as I can form an opinion from the careful perusal of the various reports made upon that property, the business, when originally brought out before the public, seems to have been conceived much more in the way of a mere speculative operation in the share markets than as a legitimately planned mining enterprise. It would be difficult to explain otherwise the glowing anticipations inserted in prospectuses, and supported by the evident exaggerations contained in certain reports.

It should have been clear from the beginning for the promoters of that speculation that the public could not be misled with such trash, and would not condescend to assist them in their operation. Yet they would not renounce, and thus the Alianza de Cicapra property has been kept unworked and undeveloped to the present day. That this property is very rich and valuable is satisfactorily established by statements made by gentlemen whose reputation and social position fully attests the honesty and loyalty of their declarations, wholly independent of the original reports presented by Mr. Fitzgerald.

What was and what is wanted to make this property a very profitable investment is simply that it may be worked properly under the management of a thoroughly competent and practical mining engineer, fully experienced in the treatment of auriferous ores, and supported by an earnest and energetic board of directors.

WASSAU GOLD MINING COMPANY, AND ITS PROSPECTS.

Sir,—This company, which was started in 1881, for the purpose of further developing a valuable gold mining property, for which purpose a large sum of money (75,000*l.*) was paid to the vendors, including machinery, plant, buildings, &c., on the property, as per original prospectus, and a further outlay has been made in additional machinery, yet it is not even paying the cost of working expenses.

As a shareholder I, therefore, feel a personal interest in the concern, and am inclined to ask why is this the case? Have all the arrangements in the Memorandum of Association of this company been tried? Is the mining carried on legitimately, and by a competent staff? Is there a sulphide or sulphuret of gold met with in this property, and if so is there any account taken of it? Has the hydraulic system been tried? If not, why not?

The stamping-power is said to be 10 tons per day, I presume, as the result of 36 heads of stamps, while in Cornwall Mr. Husband's pneumatic stamps have stamped at Tregurtha Downs 23 tons per head per day through a 36-hole grate. I fear the Chairman and some of the directorate know little about mining; and it is said that the staff might be more efficient at the mines, and that while the present state of things continues they will not be in a position to pay dividends, although the property may be good. N. B. H.

Helston, Sept. 23.

CANADIAN MINING, RAILWAY, AND GENERAL INTELLIGENCE.

Sir,—The Ontario and Quebec Division f the Canadian Pacific Railway.—At last after numerous delays the great work the Ontario and Quebec section was opened on Aug. 11. The chief delay occurred at Kaladar, where the track kept continually giving way, although it was filled up several times. An enormous amount of earth, trees, bush, and other material was dumped into it, but when the heavy test trains went on again it gave way. The line, therefore, was not opened till Aug. 11, although the opening was expected to have taken place some weeks before. Since the opening the traffic has been good, particularly in connection with the West and the Michigan Central. The Credit Valley division is taken west of Toronto, and connects with the Michigan Central at St. Thomas, where there is a splendid line through to Detroit and Chicago. This new line is what Ontario requires. The Grand Trunk running along the lake and river, and the Canadian Pacific through the interior of the province, will give us two trunk lines. In case of any strike on the Grand Trunk Railway the other line will be available, while the Canadian Pacific Railway will cause the growth of several new towns. It will be a great benefit to Peterboro, to Perth, and to Ottawa, and each year the traffic is likely to increase. Already in the few weeks that have taken place since the opening the traffic of the Canadian Pacific Railroad has increased, while that of the Grand Trunk Railway has decreased. So far as passenger travel is concerned there is little wonder that passengers prefer the new cars, splendid palace coaches, good time, and good accommodation of the former, rather than the old rusty travel-stained dirty cars of the latter. If the Grand Trunk Railway hopes to retain the through passenger travel the company must clean up, and paint up, and furnish cars equal to their new rival. When the Ottawa travel is taken into consideration it is safe to say that almost all of it will go by the Canadian Pacific Railway.

As the *Mining Journal* of Aug. 30, just to hand, gives the account of the opening of the British Association for the Advancement of Science and the address of Lord Rayleigh, the papers that were read will also appear in the Journal, or be open to the scientific reader, it remains for me only to notice the outside "show." What particularly struck us was the peculiarity of the dresses of the ladies and their general appearance. If the British Science Association ladies are fair specimens of English beauty and good looks, or English taste in dressing, they ought certainly to emigrate to America and take lessons. But it is not to be expected that science will encourage dressing in ladies, though why the science of dress is not of sufficient importance to gain attention may, perhaps, be a question. Some of the members of the Association went to Niagara, others to Guelph to see the model farm, and others across the country to Winnipeg and the Rocky Mountains. The railways vied with each other in giving them passes, and the people tried to make it pleasant. The weather has been delightful, so that, on the whole, the visit of the Association may be looked upon as a success, and it is hoped that it will result in giving many of the people of the old land a true and just opinion of the country.

The Toronto Exhibition, which is held annually, was opened by the Lieutenant-Governor on Wednesday last. The first week is not considered the best, as most of the visitors reserve themselves for the cattle and full exhibition of the second week. Still, there are many things worth seeing. Among them the electric railway attracted a good deal of attention. This is run on the Vandepoel system, and appears to be a success. It seems admirably adapted for street car traffic, although the cable roads are being used with great success in the States. As your readers are probably fully acquainted with the principles on which it is conducted, I shall not trouble you with a description of the electric railway. The show of carriages was good, and the new springs and other improvements deserve attention. The Wilson gear for buggies, an improvement on the Brinster buggy, which is so popular in New York, and challenge gear, which was only invented last April by Mr. Dowsley, of Owen Sound, are both good. The challenge gear may be thus described—The inventor has succeeded in overcoming the great difficulty hitherto existing in plate springs: 1, by making a spring that will ride as easy with one person as with two; 2, by making a spring that will not break by over-loading. This is done by separating the plates, which does away with the friction, while in the case of over-loading the strain cones and endways on the bottom plate passing around the sweep at the end of the spring. It adjusts itself to any sustaining capacity, while at the same time a much lighter spring may be used. This patent truss-plate spring gear is likely to come into general use.

The Mowat Celebration.—The return of Mr. Mowat from England, and his success in the latter for provincial rights before the Privy Council, has been seized upon by the Grits, and they are trying to work up a mighty excitement. The Globe is just "booming" and goes its "bottom dollar" on Mowat. That Mr. Mowat has done his duty none will deny. That the boundaries had to be settled authoritatively all in Canada fully knew, and that the matter had to come before the Privy Council. Why did not Mr. Mowat bring it before the Privy Council before this? Sir John A. Macdonald wanted the matter decided, but Mr. Mowat did not want it decided, as it was a good election cry. If Sir John had been in Mr. Mowat's place and Mr. Mowat in Sir John's place both would have acted as they have acted only on opposite sides. It was the duty of Sir John to advocate the rights of the Dominion; it was the duty of Mr. Mowat to advocate the rights of the provinces; and it was the duty of the Privy Council to decide. Both argued as well as they were able, and it does not appear very good taste to crow over the defeated party. If the country belongs to Ontario, let her have it; if to the Dominion, let her have it. You see Manitoba is placed in a different position from the other provinces. In the other provinces the land belongs to each province; but in Manitoba and the North-West Territories the land belongs to the Dominion Government. The real contention was, therefore, between Ontario and the Dominion.

Several papers contain statements of facts, and these facts are of value if you are moderately sure that the statements are true. I, therefore, extract a portion of the Globe's article on "This Ontario of Ours":—"As at present under our new boundaries Ontario has a territory of 90,000 square miles in extent, and extends over 10° of latitude and 20° of longitude. From Point Pelee, in Lake Erie, to Fort Albany, in James Bay, is more than 700 miles; its length from Point Fortune, on the Ottawa, to Rat Portage, on the Winnipeg river, is more than 1000 miles' It is larger than the States of Ohio, Indiana, Illinois, and Michigan by 10,000 square miles; it is larger than Iowa, Minnesota, and Wisconsin by 11,000 square miles; larger than the six New England States, together with New York, Pennsylvania, New Jersey, Delaware, and Maryland by 25,000 square miles; and larger than Great Britain and Ireland by 78,000 square miles. It is only 4000 square miles less than the French Republic, and only 8000 square miles less than the German Empire. But Ontario has something more to boast of than a broad expanse. It has a fertile soil, an invigorating climate, vast forests of merchantable timber, treasures of mineral wealth, waterpower of limitless capacity; and better than all these, it is peopled by a hardy and energetic race of men, growing up under the enobling and inspiriting influence of free institutions, free schools, free speech, and a free press. It has extensive areas which grow a better sample and a larger average yield of the staple cereals than any other portion of the continent [I do not believe this statement when compared with Manitoba], and it has more extensive areas not yet brought under cultivation, which may be converted into grazing lands of unsurpassed richness, suitable for the production of the best qualities of butter and cheese, beef and mutton. We have here the natural *habitat* of the combing wool sheep, and the best breeds of British cattle and horses preserve their characteristics as well here as on their native heath. Highways and railways are rapidly opening up the country; mills, factories, and markets are being established wherever settlement extends; and the beat of the pulse of commerce is being felt in the remotest townships. In a word, this Ontario of ours is a veritable land of promise. It contains within itself all the elements which go to build up national greatness [except a true press]. In agriculture, manufactures, and the arts it has already attained a distinguished place, no better proof of which can be required than what is to be seen to-day in our city on the grounds of the Industrial Exhibition."

With the few corrections that are made I think this statement is pretty correct. But I remember that this same paper not many weeks ago was running down the country and blaming the Dominion Government for bringing out immigrants. According to the Globe a few weeks ago, our manufactures were in ruins and our condition one of great depression, and everything going to ruin unless the Grits were put at the head of the Dominion Government. Now they are "booming up" Mr. Mowat, and Ontario is a perfect paradise, and Mr. Mowat made it.

As for mining, Mr. Mowat has been at the head of the Government of Ontario for over ten years, yet he has not done one single stroke to encourage or improve mining. He has not even altered the foolish old statute that Mr. Stephen Richards passed when he was Commissioner of Crown Lands away back in the ages. That still remains on the Statute Book, and Mr. Pardee, the present Commissioner of Crown Lands, seems to know only about as much as Mr. Richards with regard to mining. As the new territory is chiefly a mining country we may, perhaps, expect something to be done, though "blessed are they that expect nothing, for they will not be disappointed."

The Rocky Mountains.—From Laggan, on the Canadian Pacific, we have to chronicle the death of Mr. Richard C. Fowler, county of Bucks, England. He took typhoid fever and died in a week's illness. The amount of work done in this division during the summer is wonderful, for by the end of next month the line will have been graded down to the first crossing of the Columbia river, leaving nothing but the bridging and tracklaying to be done in the Rocky Mountains, as that crossing is at the western toe of this mighty chain of mountains. E'er October closes the locomotive will pass over this river for the first time, and it will probably reach the foot of the Selkirk range before they stop laying track for the year. Though, of course, it will be impossible to lay track during the winter months, nearly the entire staff of engineers will be kept busy, and the bridging and rock work vigorously carried on. The locating will be finished early next year, if not this. Some stupendous trestling will be necessary on this side of the Selkirk range, as the ravines are everywhere from 200 to 600 ft. long and over 150 ft. deep.

The subjoined account of a steamer transported 40 miles on men's shoulders in British Columbia will be of general interest. The Spokane Falls (Nev.) Chronicle says:—A remarkable feat is now being carried out by a young Englishman representing a party of English capitalists who have acquired a large block of land from the British Columbia Government in the exquisitely beautiful lower Kootenay Valley, lying just over the northern confines of Idaho, where the international boundary lines separate the waters of Pend d'Oreille lake and Kootenay river. This pass traversed by a narrow Indian trail, which winds through the almost impenetrable forests that clothe this great spur of the Rocky Mountains known as the Clarke's Fork range, has never been passed by a wagon, and now a steamer, the hull built of teak in one piece, is to be spirited across this mountain barrier for a distance of 40 miles. A large force of Indians belonging to the Kootenay tribe, a race that has as yet remained perfectly untouched by civilisation and who have never seen a white woman, have been engaged, together with 10 or 12 white men, to help in the work.

The little steamer has seen much travel. Built last year on the banks of the placid Dee, that washes the Roman walls of beautiful Chester, one of England's oldest cities, she made a summer trip to the rock-bound coast of Norway, where her owner explored some of the most inaccessible fiords of that picturesque coast, bent on salmon fishing and bear hunting. Brought back to England, she left Liverpool safely stowed away on the deck of the Polynesian, one of the ocean leviathans, May 21. Laden at Montreal, she was placed on the deck of one of the large propellers running from that point to the western extremity of the great lakes, Duluth, when, after passing through some 150 locks that make navigation through the long chain of great lakes possible, and after a narrow escape from being wrecked on a hidden rock, on which the propeller struck one dark night heavily, she safely reached the latter port, when she was immediately placed on a flat car, on which, afer being placed in bond, to enable her to pass through the United States, she began her long transcontinental journey of 1500 miles over the Northern Pacific line to Sand Point, or Lake Pend d'Oreille. Bouronite.

Toronto, Sept. 13.

LEAD MINING IN THE LAKE DISTRICT—No. III.

Sir,—When I wrote my last article on the above subject it was my intention to have troubled you for a small space in your valuable Journal again long ere this, and if any of your numerous readers who are interested in the subject have been expecting my promised article I would say that absence from the district and pressure of business has been the cause of the apparent neglect, and in returning I am gratified to find that in these excessively dull times in mining this district stands out as an oasis in the desert.

Brandley Mines.—Since my last tour I notice here a great change, all the great reservoir of water which some experts thought would never be drained (as it had been stated to have broken in from the adjacent lake Derwentwater) has all been pumped out, and my statements and those of the old Cumberland miners have been proved true. The vein in the bottom shows from 1 to 4 ft. in thickness of solid galena, and I am informed there are other good displays of ore in the old levels. I hear there is a departure from the usual routine of mining, by letting the engine pit to sink 120 ft. deeper to a firm of Liverpool contractors. This will undoubtedly give the company an available reserve of thousands of tons of ore, but what a difference it would make in the profits if lead were only 15*l.* per ton. No other mine that I know of can show better prospects for permanence, and I would give one word of advice to the proprietors, and that is for them to join hands with the slate quarries, and make one more effort to get a Bill passed for the construction of a line of railway from the C. K. and Penrith Railway on to the mines and quarries.

Threlkeld Mines.—Here a large output of lead and blende steadily pours into the market. The mine is a sound property, and pays well, but it, too, suffers from the low prices of lead. I am informed that rich veins of ore are being wrought, and that a deeper adit is being run to tap the ore below the present workings, where it is confidently believed it will be found increasingly rich.

Barrow.—This mine also steadily improves, but a little more spirited development is required; the mine wants deepening as well as lengthening. The company need not be afraid to extend operations, as they are beyond dispute on the right track, and have a good mine. There is a large pile of lead on the surface, and washing machinery is needed for its treatment.

Thornthwaite.—Here the steam-engine has been superseded by the erection of a large water-wheel. There is some fine lead laying on the surface, and I am informed the mine looks well below, and good reserves of lead and blende are ready for the miners to work at.

Yewthwaite.—Very little seems to have been done here since my last tour. One set of men are engaged wooding and cleaning the Trustees adit. It is a pity the development lingers, as it is a genuine property, and is a continuation of the Barrow and Thornthwaite Mines vein.—*Sept.* 30. Skiddaw.

MEXICO AS A FIELD FOR MINING INVESTMENT.

Sir,—For more than 200 years has this country been famed for its rich silver mines, and yet as far as mining development is concerned it is still in its infancy. This is due to two principal causes—first, the past unsettled state of the Government, which has kept back foreign capital to a great extent; and, second, the now speculative character of the Mexicans, they being content to work the rich deposits and lodes discovered by the Aztecs and Spaniards, and not troubling themselves to look up other mines, or even to prosecute the continuation of the lodes already proved to be so rich. But the first and most important drawback to the advance of Mexico has been removed, as the firm basis on which the Government is now formed has made revolutions a thing of the past, and the protection and encouragement afforded to foreign capitalists have tended to place this country on the high road to that important position it is bound to occupy among the nations of the world.

Another great impediment to mining here was the absence of any adequate means of transportation from the ports to the interior of the country; but this has also disappeared before the railways which have been constructed during the past ten years in different parts of the Republic. I will just quote a case or two to show the difference railways have made in this town (Pachuca). Fourteen years ago it used to occupy from 14 to 21 days to get machinery from the port of Vera Cruz to this place, the cost of carriage of which was about 50*l.* per ton. It now can be brought up in three days at a cost of 12*l.* per ton. Formerly the journey to Mexico city would occupy from 15 to 20 hours, we now do it in seven hours. Nor is this all, because we can now send our best minerals to England to be reduced at a greater profit than we can get here by the old "patio" process, which is the only method employed here. During the last five years the writer has travelled nearly all over this country in his capacity of mining engineer, and he is convinced that no country in the whole world offers such splendid inducements to investors as does the mining industry of Mexico. Mining here can more properly be called an investment than a speculation, as a glance at the statistics of the mines will convince the most sceptical.

Probably the richest State in the Republic is Hidalgo, where a good deal of European capital is now being invested to good purpose. Although foreign capital is fast coming in, "and still it comes," yet there is plenty of room, and my advice to English investors is to investigate for themselves; there are Englishmen here who through long experience are well acquainted with the country and its mines who, I am sure, would gladly give any information to intending investors; and, in fact, the writer, who is an Englishman, would gladly render any assistance in his power to his countrymen in this matter.—*Pachuca, Sept.* 12. Henry Hill.

THE MINING AND TECHNICAL COLLEGE FOR WALES.

Sir,—I have read with pleasure your article on "The Mining and Technical College for Wales" in the *Mining Journal* of Sept. 27. You are, however, in error in supposing that the enthusiasm of the promoters and ardent supporters of the proposal has in any way diminished. Our case is before the Government, and we are waiting for the promises given by the Prime Minister, Lord Carlingford, and others (to give the request made by us on behalf of Swansea every consideration) to be carried out.

Personally I have every confidence that Swansea will have a grant worthy of the great national object in view, especially for the reason that it is difficult to understand how it is possible to ignore the chief town of the Principality, and as you so pertinently described it "the centre of the metal trades of the kingdom"—whilst towns like Bangor and Aberystwith have received large grants. Previously to seeing your article I had asked the town clerk to apply to the Prime Minister, Lord Carlingford, and Mr. Mundella for some further communication in reply to our memorials, so that I may lay it before the Corporation of Swansea before my year of office as mayor shall have expired. Robert D. Burnie, Mayor.

Swansea, Sept. 27.

IMPROVED MINING FAN.

In conducting mining operations few things are of greater importance to secure speed and success than good ventilation, and it can scarcely be doubted that in metalliferous mines the adoption of a fan that could be worked by a couple of men and keep an end clear and wholesome, would, in many cases, make the difference between loss and profit. One of the most attractive stands at the Health Exhibition is that of Messrs. H. Aland and Son, of Commercial-road, Lambeth, where their new patent mining fan is now in full operation. In some tests with a 3 ft. 6 in. fan, 1 ft. wide, it was found that with a speed of 586 revolutions per minute, the area of suction being 7½ ft., the quantity of air exhausted was 36,000 cubic feet per minute, the water-gauge pressure being 2½ in. At 680 revolutions per minute, same area of suction, the air exhausted was 40,050 cubic feet per minute, the water-gauge pressure being 2¾ in. The area of suction was then increased to 10 ft., and with a speed of 619 revolutions per minute the quantity of air exhausted was 53,000 cubic feet per minute. It is claimed that these results being more than double that obtained by any other fan yet made of same size. The reason they gain such extraordinary high results with this new patent fan is it being well known that in all volume fans the blade travels double the speed of the air, consequently a great vacuum takes place behind the blades, they fill this vacuum with air by openings in the side plates of the revolving impeller. The intake of fan impeller is increased to about the diameter of the revolving impeller itself, so that a 3 ft. 6 in. fan of this construction would have an inlet or feed surface of 3 ft. 4 in. diameter, it will, therefore, be clear that by this increased feed surface how we are able to gain such high results and pass so large a quantity of air. This fan can also be used for a large volume at a low pressure, or a restricted volume at a high pressure. The letters patent are also secured for these ventilators to draw from either one or both sides, so that in the case of a building to be ventilated, they can be fixed in any position, ceiling, wall, or floor, drawing foul air or vapours from the building and discharging into the outside atmosphere, or drawing fresh air and discharging into the building, or supplied double power, and exhaust in at both sides and discharge where convenient; in either case the feed or suction surface is as large, or nearly so, as that of the revolving fan or impeller, and the water-gauge pressure is nearly equal over the whole of feed or suction surface, unlike all other air propellers and fans.

But the high speeds above referred to are by no means essential to the efficiency of the fan, and the excellent duty obtained with a very low speed is, perhaps, the greatest recommendation of the machine. In a careful test of a 4 ft. fan run with a belt (in the first test the width of the belt was 3 in., and in the remaining six 2½ in.) the results obtained were:—With 400 revolutions per minute, 62,500 cubic feet of air per minute; with 335 revolutions, 44,500 cubic feet; with 310 revolutions, 42,700 cubic feet; with 300 revolutions, 38,500 cubic feet; with 250 revolutions, 32,370 cubic feet; with 200 revolutions, 26,860 cubic feet; and with 180 revolutions, 22,240 cubic feet. The two latter speeds were obtained with the power of two men turning handles; and all the above speeds with a proportionate small amount of power. It gives four times the amount of pressure of any air-propeller hitherto in use, and it will discharge at 400 revolutions three times more air than any other ordinary fan. Now, the cases in which a current of 22,000 cubic feet of air per minute, obtained by manual labour only, would be useful, are almost innumerable, and

it is, indeed, thought to be questionable whether it would not be profitable to use such a fan (for no other purpose than to clear out the smoke and foul air after a shot has been fired; the men could be at work again in 10 minutes after the explosion, instead of wasting half an hour, as they frequently do when the air is dead, to let the smoke clear off. When a large pare of men are at work the avoidance of this waste of time would soon amount to a sum that would cover the cost of a fan. When these small fans become better known they will no doubt be largely used, but hitherto really little has been done to make would-be users aware of their existence. The inventors claim that their triplicate mine and colliery exhaust fan would supersede others for colliery ventilation, and that a 12-ft. diameter fan is of sufficient capacity for the largest coal pit in operation.

FOREIGN MINING AND METALLURGY.

The condition of the French Iron Trade has, if anything, been changing for the worse during the last few days, as prices have continued to decline. Merchants' iron has only been quoted, for instance, during the last few days at 6*l.* per ton. The steelworks have obtained a few orders amid the general dulness. An Algerian railway company has, for instance, just ordered 300 tons of steel rails from the Steelworks Company of France at 6*l.* 12*s.* per ton, delivered in Algeria. The Nearrel Works have obtained an order for some of the *matériel* required in connection with a Spanish ironclad, which is to be built by the Forges et Chantiers de la Méditerranée. The imports of iron minerals into France in the first eight months of this year are officially returned at 880,201 tons, as compared with 1,092,653 tons in the corresponding period of 1883, and 939,918 tons in the corresponding period of 1882. In the total of 880,201 tons, representing the imports for the first eight months of this year, Belgium figured for 136,989 tons, Germany for 285,832 tons, Spain for 30,056 tons, and Algeria for 110,312 tons. The intelligence received with respect to the German iron trade presents no features of special interest. Prices have been generally maintained, and the steelworks have continued to be well employed. The Austro-Hungarian iron trade has shown a quiet tone.

In the Belgian Iron Trade quotations have shown no change. Belgian works will supply almost all the accessories—tyres, wheels, &c.—required for the trucks recently ordered for use upon the Panama canal works, although some of the contracts for these trucks were taken in France. The Vennes General Water-Pipes Company has obtained a contract for all the pipes required in connection with the water supply of Bremerhaven, on the Weser. The contract comprises 1700 tons of pipes, and it should be added that it was obtained in spite of English and German competition. The Rodange (Grand Duchy of Luxembourg) Blast-Furnaces Company has just issued its report and balance-sheet for the year ending June 30, 1884. In consequence of the low rates which have prevailed for pig of late the company has not been enabled to quite maintain its dividend at the same rate as in 1882-83. Nevertheless, a profit of 17. 8*s.* per share has been declared for 1883-84 out of a profit of 4819*l.* realised for the year. The directors of the John Cockerill Company state in their report for the year ending June 30, 1884, that the production effected by the company's collieries last year was 389,000 tons. The production would have been more considerable but for the depression prevailing generally in European industry.

Although Belgian coalowners have shown some disposition to raise their prices, no advance has been actually attempted in household coal this month. The temperature has been hitherto much too high, and the season has been much too fine to admit of higher rates being proposed. Coalowners feel that they must await the first frosts of the season before venturing upon anything of the kind. In the Couchant de Mons the situation has scarcely varied. The number of trucks carrying coal and coke which passed over the Belgian State Railways in the third week of September was 18,316, as compared with 18,995 in the corresponding seven days of 1883. The approach of winter has imparted a certain activity to the German coal markets, and deliveries have acquired rather more importance. The daily movement of coal over the railways accommodating the basin of the Ruhr amounted, for instance, to 77,770 tons in the first half of September, as compared with 76,530 tons in the second half of August. Quotations have not varied at present upon the German markets, but it is stated that attempts will be shortly made to obtain higher terms for household coal. As regards coke no advance seems probable, but prices will in all likelihood be firmly maintained.

FINE CRUSHING WITH THE STONE-BREAKER.

The stone-breaker is now very generally used about mines for breaking ores, yet it has not hitherto been regarded as adapted even in principle for fine crushing; but in a paper read at the Chicago meeting of the American Institute of Mining Engineers, Mr. Theodore A. Blake, M.E., of New Haven, Connecticut, read an interesting paper, in which he showed that with a modification of the original Blake stone-breaker fine crushing is both practicable and economical. He remarked that although originally designed for breaking stone for road-metal, its importance for crushing ores of the precious metals, and those of iron, copper, and zinc, as well as emery, phosphates, plaster, &c., was soon recognised, and for many years its use has been world-wide, and its construction is so well known that no special description of it is deemed necessary. Following its introduction, many different machines for the same purpose containing the same essential features of upright convergent jaws, one of which is movable with respect to the other, but having some slight modification of such movement (generally a rubbing motion) or of the non-essential method of imparting motion to one or both of the jaws, have been offered to the public for sale and use, but have as a rule in time disappeared from the market. If we seek for the reason of the success of the Blake crusher, aside from its simplicity of construction, we shall find it in the adherence to the principle of crushing by simple pressure and careful avoidance of attrition. In this lies the economy of power and of wearing surfaces.

To reduce any hard and brittle material to a fine powder by many different methods—by attrition, impact, or percussion—is a comparatively easy matter; but to accomplish this by the employment of either of the above-mentioned principles involves such a consumption of wearing surfaces (generally iron) or of power that the numerous devices that have hitherto been presented to the public as solutions of the problem of fine crushing have proved utter and complete failures when tested with reference to the power employed and the wear of iron in doing their work. Aside from the use of crushers, with the harder ores, the only two methods of fine crushing in general use, and, in the writer's opinion, worthy of consideration, are by means of stamps or rolls—the former doing their work by percussion, the latter by pressure, provided they are properly run and fed, but generally by pressure and attrition combined. It is not proposed, within the limits of the present paper, to enter on a detailed analysis of the comparative economy of stamps and rolls. Of the greater economy of crushing with rolls, as compared with stamps, the writer has no doubt, provided the material to be crushed by the rolls is already broken to a small and tolerably uniform size before being fed to them, and the feed is uniformly distributed in such a manner as to avoid any accumulation of material between them. If fed with such materials their tendency will be to wear evenly; and if accumulations of material between them are avoided, they will not be thrust apart, their product vitiated, and unnecessary power consumed.

In crushing, either by stamps or rolls, efficiency largely depends upon the preliminary work with the crusher. To reduce any material fine enough to be fed to rolls, to secure the best economical results, it is necessary that it should be crushed to about corn-grain size, or (say) ¼ in. diameter. When ore is reduced to this size by a crusher it is safe to say that from 20 to 30 per cent. of it will pass a 50 or 60 mesh screen, that is a screen with from 2500 to 3600 holes to the square inch. If then, so large a percentage of the material can, in a preliminary operation with crushers, be brought to such a fineness, why cannot the whole be reduced to the same degree of fineness? The great difficulties, however, in crushing fine with an ordinary Blake crusher have been the liability of the material to pack in the jaws, and the greatly diminished product of the machine when the jaws are set so as to yield a fine product.

The solution of the problem of fine crushing will be found in making the discharging capacity of a Blake crusher, when set to crush fine, sufficiently great to permit the rapid discharge of the material as it is crushed. This requirement is fully satisfied by the writer's invention of the Blake fine or multiple-jaw crusher—a machine the value of which, when fine crushing is required, will, in the writer's opinion, prove to be as much greater than that of the ordinary Blake crusher as fine crushing is more difficult than coarse crushing. In the Blake fine or multiple-jaw crusher, while the principle of crushing is the same—that is, simple pressure between upright convergent jaws—the discharging capacity may be increased to almost any reasonable limit, even if the crusher is set to crush to a great degree of fineness. The Blake system of fine crushing, then, consists in nothing more than the use of a series of crushers, beginning with one sufficiently large to receive the largest fragments and to give the required hourly or daily product, and ending with a fine or multiple jaw crusher, from the products of which that which is sufficiently fine is withdrawn by screening or other methods of separation, and the coarse returned to the same machine to be still further crushed. The crushing is done between a series, in this instance, of sliding jaws supported by and sliding upon the main tension-rods or both. These jaws are separated by and held by rubber rings placed between them on the tension rods.

The method of imparting motion adopted is the same as in the regular Blake crusher, by means of the toggle-joint, pitman, and eccentric shaft. The revolution of the shaft, bringing the toggles more nearly into line, throws the main sliding jaw forward, thus compressing the whole series of sliding jaws, the crushing pressure being transmitted through the material to be crushed, with which the jaws are supposed to be filled. It is evident that, if a piece of iron or steel should by accident get into one or more of the jaws, the only result would be to render that jaw for the time inoperative, the motion that it would have with respect to the next succeeding one being taken up and distributed through the other jaw openings. It is claimed that the Blake system furnishes an efficient system of crushing with crushers alone, and in the new multiple-jaw, or fine crusher, the old Blake crusher over again, so far as the principle of crushing is concerned, with an entirely new and completely effectual provision against breakage, due to the multiplicity of its jaws.

The results already attained have been so remarkable that the writer thinks it perfectly safe to assert that the problem of fine crushing has been by this invention completely solved; that the days of the old stamp mill for ores of the metals and the burr stone for phosphates and cements are practically numbered; and that they will shortly be replaced by a machine quite as simple and even more durable than the original Blake crusher, which was intended and is invaluable for spalling or reducing ores to a size suitable for further reduction by other means. The first example of the Blake system is to be found at the works of the Chateaugay Ore and Iron Company, near Plattsburg, New York, of which Mr. A. L. Inman is the general manager, where the writer designed and placed a crushing plant of the capacity of 200 tons a day, from 10 in. to a size to pass a ¼-in. round hole. The works were run continuously day and night for six months, giving even an excess of the daily product required, but are now idle on account of the dulness of the iron market. The ore is magnetic iron in grains disseminated through a tough feldspathic gangue. Works for the same company of a capacity of 1500 tons a day are in contemplation. The second example is at the works of Messrs. George H. Nichols and Co., of Laurel Hill Chemical Works, of which Mr. J. B. F. Herreshof is the manager, where a small plant consisting of one 10 by 4 improved Challenge and one (24 by ¼) 7 multiple-jaw crusher, was put in to crush copper matte. The requirements were 1 ton an hour to 20 fine. The machines replaced an 8 by 12 Dodge crusher and a pair of 24 by 12 Cornish rolls, of which the product was about 500 lbs. an hour to 20 fine; while the product of the Blake system, with machinery about one-third the weight, was 3000 lbs. an hour, with an expenditure of less than one-third of the power required by the crusher and rolls. The third example is at the works of the Orford Copper and Sulphur Company, Bergenport, New Jersey, where a duplicate plant to that of No. 2 has just been installed. Other plants for gold ores, phosphates, &c., are now on the way to destination for installation.

AUSTRIAN RAILWAYS—A FIELD FOR BRITISH ENTERPRISE.

Referring to the commercial progress at present being made in Dalmatio, Consul Stigand, writing from Ragusa, remarks that the chief want of the district is railway communication. With the exception of the small steamer going three times a month to Trieste, we are entirely dependent on the Austrian Lloyd's steamers for postal and other communication with the rest of Europe; and although the distance from Trieste is only 332 sea miles, these steamers take sometimes four days and never less than two to perform the distance, owing to their frequent stoppages and to the injunctions given to the captains never to do more than eight miles an hour. With railway communication, of course, the distance might be performed in half a day. The great question naturally in the establishment of railway communication is whether it could be made to pay, and in spite of the fertility of some portions of the narrow strip of coast which runs down here from Trieste on the west side of the Dinaric Alps, it may be doubted whether, so far as Dalmatia alone is concerned, a railway would at present cover the expenses; however, it is pretended that if a railway were established the industrial and agricultural interests of the country would receive such extension that it would not fail to do so in time. It may, too, happen that the Austrians may ultimately find it necessary to construct a railway for military reasons.

When Austria occupied the provinces of Bosnia and the Herzegovina in 1878 it was expected that great changes would result for this town and district. A change has certainly been produced, and that one not agreeable to some of the inhabitants of this place here, in the rise of the price of commodities, caused by the demands for supply of the garrison and officials of Trebinje. This rise of prices, however, is evidently a benefit for the agricultural population, while the importation of building materials for the works constructed and in construction, a greater portion of which are tiles from Venice, has given greater activity to the harbours both of Ragusa and Gravosa. However, Ragusa looked forward to being again the chief mart and seaport of the Slav provinces of the Balkan, but in this expectation the city seems likely for the present to be disappointed. It is evident that Bosnia and the Herzegovina require railway access to some seaport on the Adriatic; without this they will remain as they have hitherto been, cut off from the rest of Europe, and it has been said that the seaboard of Dalmatia is so necessary for Bosnia that without Dalmatia the province is a head without a face. There are only three seaports available for the purposes of the provinces—Ragusa, Metkowich, and Spalato. The first two ports are, however, the only ones available for the Herzegovina, and at was hoped at Ragusa that after the Austrian Government had found it necessary to construct a line from Brod to Serajevo it would prolong it to Mostar, and from thence conduct it by Stolatz to Ragusa, with a branch line to Trebinje, and that thus Ragusa would become again the chief port on the Adriatic of the Balkan provinces.

The Austrian Government, however, have for the present decided on making a line from Mostar to Metkowich, with the view of an ultimate extension from Mostar to Serajevo. They have no doubt been influenced in this determination by the consideration that the line from Mostar to Metkowich is much shorter and easier of construction than the line from Mostar to Ragusa. There is no comparison, of course, between the two places regarded as harbours and sites for a city. Metkowich is at present but a poor village on the Narenta, situate at the edge of a fever-stricken alluvial plain, which runs down in marshes to the sea. The voyage up and down the Narenta from and to its mouth is not easy on account of the winding character of the stream and its frequent inundations, and it takes about two hours to perform, and is not suitable for large vessels. Metkowich, however, has been rising in importance ever since the occupation of the Herzegovina, and as I have before mentioned it has now direct steam communication with Spalato. The distance from Metkovich to Mostar is not more than 50 miles, and has but one mountain—the Dubrava Platina—to get over before descending to the plain of the Narenta. The line from Mostar to Ragusa would, after leaving the Polje, or plain in which Mostar is situated, have had to pass through a very mountainous country, and the whole line would have been about thrice the length of that to Metkowich. It is to be hoped, however, that Ragusa will yet be able to get her line of communication with the lines of the Herzegovina, so as to place the city in railway relation with Vienna and the rest of Europe.

MINING IN DERBYSHIRE UNDER THE DERBYSHIRE MINING CUSTOMS AND MINERAL COURTS ACT OF 1852.

No. VII.—By W. Niness, M.E.

Article 5.—Every miner shall so long as his mine shall be worked be entitled without making any payment for the same to the exclusive use of so much surface land as shall be thought necessary by the barmaster and two of the grand jury, and be set out by them from time to time for the purpose of laying rubbish, dressing his ore, buddling, making mears or ponds, and conveying water thereto, and any other mining purposes. The miner shall in all cases before he commences any search or uses any land make fences sufficient for the protection of cattle from any injury which might arise from his operations, and keep the fences so from time to time to be set up in sufficient repair if required by the landowner or occupier so to do. Provided always that nothing herein contained shall entitle any person to use any lands for the purpose of buddling old hillocks which at any time of such buddling shall be grassed over or otherwise cultivated (notwithstanding a mine may be in workmanship) without rendering and paying to the owner of such lands 1-30th part in value of all such lead ore as shall be found and gotten in and from such old hillocks, and when such lead ore shall have been made merchantable and fit for smelting, and shall have been measured by the barmaster, and (if required by such landowner) before the same lead ore shall be removed and taken away. Practically speaking, "so long as his mine shall be worked" means so long as no outsider interferes with his mode of working, which is rarely if ever the case.

The privilege vouchsafed to the miner by this Article is a substantial one, as he is not liable to pay compensation for the surface land taken for the purposes of his mine. This Article also gives the miner power to lay rubbish, &c., upon such surface land, and to some extent controls the general power given to the landowner in Article 2, with which it must be read (Tapping). The remarks of this authority in reference to this Article are correct, as it wholly exempts the miner from one of the most serious items he has to face in pursuit of his industry in other countries—that of compensation, in the majority of cases considerably more than is just, for trespass and land damage. The relief thus afforded the miner in this instance cannot be too highly estimated, and I consider it one of the most valuable privileges he possess throughout the Act.

Several reliable authorities who have written on these customs assert that the miners formerly could claim "the next wood and water of the King's land to timber their ground under and above earth, and, therefore, the miners pay lot to the King." This was the origin of paying lot (dues); instead of paying the King for the wood in coin, a certain portion of lead was set aside for that purpose, which eventually and unfortunately developed into dues. At one time the King owned a smelting-mill, to which the miner conveyed his ore, and received the market price for it, whereupon no cope was paid; but for some purpose or other the King disposed of his smelting-mill, and in consequence cope came into fashion, and is apparently as fashionable now as ever is was.

In Wirksworth the income of the vicar depended on the lead mines; he received a lead ore tithe. In the reign of James I. he was entitled to every tenth dish on paying a penny to the miners for dressing it. The mines some years ago yielded an enormous quantity of lead. Cox in his Derbyshire Churches says—"The vicar's tithe in 1852 was about 1200*l.* from a single mine, but we are told it has never reached more than 600*l.* or 700*l.* per annum since that time." Manlove, in reference to the vicar's tithe, writes—

Provided always that to Church and lord
They pay all duties custom doth afford,
For which the vicar daily ought to pray
For all the miners that such duty pay.
And reason good, they venture lives full dear
In dangers great the vicar's tithe comes clear.
If miners lose their limbs, their lives, their strength
He loseth not, but looketh for a tenth,
But yet methinks if he a tenth part claim
It ought to be but a tenth of clear gain,
For miners spend much money, pains, and time
In sinking shafts before lead ore they find.

The above was written in 1653 by one of the best authorites on the mineral customs. Manlove at the period he wrote his poem, entitled "The Liberties and Customs of the Lead Mines" in the county of Derby, was steward of the wapentake of Wirksworth, so that the idea that duties ought to be paid only on profits is not a new one. Old or new it must, however, be admitted on all sides that it is the only solution of the miserable question of dues which regularly crops up in an odious manner, and will do so until settled.

From the paragraph previously given from Cox's Derbyshire Churches of the immense quantity of ore raised from one mine, and many others bear a similar history, an idea may be formed of the mineral wealth existing in the King's Field, and although the production of the district is at the present, comparatively speaking, small, there is abundance of ore still left, waiting a better price or spirited adventurers to work the mines with the most improved machinery. The Derbyshire ores are easy to manipulate by way of dressing, and a plant of automatic dressing machinery of the simplest type is all that is required to do so. The barmaster's fee for setting out land under this Article is 5*s.*

Article 5.—Any person may transfer his interest in any mine or vein to any other person by causing an entry of such transfer to be made by the barmaster in the book to be kept by him, as hereinbefore mentioned in this Act; and such transfer when so entered and not till then shall be valid and effectual, and any person may require the barmaster to enter any grant, conveyance, probate of will, or other assurance hereafter to be made relating to any mine in the book to be kept by him, which entry shall contain the date, names, and description of parties and consideration of the grant or other assurance, and if a will the date and name of the testator and devisee, and date of probate and name of court where proved, and the name and description of the mine or mineral property described or referred to in such document; and the barmaster shall be required to make such entry accordingly on having the original document produced to him for that purpose, and shall endorse on such document a certificate of the date of such entry and the page of the book in which it is made, and sign the said certificate, which certificate so endorsed shall be taken and allowed as evidence of such entry in all courts of law and equity whatsoever, and every document so entered shall in all questions of title have priority over all other documents hereafter made or executed which are not entered in the barmaster's book, and such documents as are so entered shall have precedence over each other according to their respective dates of entry.

That this Article was wanted will be seen from the fact that formerly there was no documentary evidence in transferring a mine or interest in one, as mines were alienated by parol. Manlove, on the authority of 16 Edw. I, art. 34, and 3 Edw. VI, art. 1 and 6, confirms this in the following words:—

By word of mouth eke any miner may
Such fee and freehold freely give away.

Such a transaction often created a difficulty, and made it almost impossible for any one person a short period together to know his whole partnership in a mine, especially when composed of persons living at a distance. To wit; it was usual for one lead burner to take up the shares of several persons' ore, and pay the reckonings and subscribe his own name as paid for such a share, including every person's part he acted for. This Article, although in the simplest and an inexpensive manner, has put the matter of transfer on a firm basis. The barmaster's fee for transferring is 1*s.* The High Peak Mineral Customs and Mineral Courts Act of 1851 awards him the following fees relating to this subject:—For transferring a mine, 5*s.*; entry or register of every transfer or other document, 1*s.*; copy of same, 1*s.*

A mortgage is a conditional transfer of an interest, and if a mortgage has been given on mineral property within this Act to be mad

legal must be transfered by the transfer being entered in the barmaster's book. A mortgagee so long as he does not take possession or contract for labour or articles for the mine, is not liable for any labour or articles supplied to the mine under the contract of the mortgagor; moreover, a mortgagee can sustain his mortgage against a creditor issuing execution against the mortgaged property in a suit against the mortgagor for such labour or articles. Respecting tools, &c., the mortgagee's remedy is by interpleader.

Formerly the entry of a mortgage in the barmaster's book was 6d., "and all persons after they have set any possessions for any groves, mines, or meares of ground, or shall by purchase or have any parts or shares given, or any possessions or meares of ground or any part of them, shall enter same, and pay 2d. to the barr-master for every meare of ground so taken up and possessed, purchased, or given as aforesaid."—(Compleat Mineral Laws.)

Scientists in the Pennsylvania Coal Regions.—An interesting and enjoyable excursion was made by the members of the British and Associations for the Advancement of Science, and the Institute of Mining Engineers, to the anthracite coal region, some particulars of which we subjoin. Starting from Philadelphia at eight in the morning in a special train of 12 handsome cars the party proceeded to Pottsville. Descriptive circulars of the whole region were given on the journey, and the members of the Anthracite Committee gave such information as was in their power. At Pottsville the train was divided into three sections, and proceeded to climb the heavy grade to the top of the plane. At Frackville the visitors partook of a hearty lunch, after which Superintendent J. H. Olhausen addressed himself to the work of lowering their cars with their occupants down the plane, which was accomplished without any mishap. Arrived at Shenandoah the most interesting feature of the trip took place—the descent into a coal mine. Of course, it would not have been possible for the whole panorama of the devious winding passages to be laid before the view of the visitors, but a section was shown which consisted of 500 ft. of gangway from the bottom of the shaft up to and including a large breast in the Mammoth Vein which had been worked out, making a cavity 120 ft. in length, 30 ft. wide, and about 20 ft. high. The roof of this cavity has a solid block of coal 20 ft. thick. The floor of this breast pitched at an angle of 14°. This cavity was illuminated by six brilliant electric lamps, and every line on the walls and roof could be distinctly traced by the eye, giving a better exhibiton than could be obtained in any other way of the strata to be found in a space of this limit. The floor of the gangway from the bottom of the shaft had been previously well layered with dry ashes, and lighted by a number of "night hawks," or large lamps used in the mines, and at the mouth of the breast steps were erected so that the visitors could step up to the entrance instead of climbing through the manhole, as is customary with the miner. Thus there was nothing to prevent the fullest exhibition of what was before a mystery to a number of the visitors, and at no expense of comfort. The lowering arrangements were as perfect as possible, and each party was allowed 15 minutes below, until at last the whole number who desired to go down, 449 in all, were gratified. The train once more moved off for the next point—the Switchback. The party took supper at Mauch Chunk, and then proceeded to Philadelphia by way of the Jersey Central, Lehigh Valley and Reading Railroads, all agreeing that the excursion in all its details was a grand success.

Bessemer Steel Plant of the Worcester Steelworks.—The Washburn Iron Company of Worcester, Mass., organised for the purpose of re-rolling railroad iron and manufacturing car wheels, has been led, owing to keen competition and the increased price of foreign blooms, to direct attention to the manufacture of their own blooms instead of using imported ones as hitherto. The company has now completed the construction of a plant with which by the Bessemer process they can carry the iron from the pig to the perfected rail. The pig-iron used is chiefly from the Lancashire district, England, and the spiegeleisen is also imported. There are two cupolas, 8 ft. in diameter and 7 ft. high, for melting the pig-iron, and one, 4½ ft. in diameter by 17 ft. high, for the spiegeleisen. The iron is run into a ladle standing upon a Fairbank's scale at one side of the casting-pit, and when 4 or 5 tons have been gathered it is lifted by means of a crane and poured into the converter, which is 7 ft. in diameter and 15 ft. high, and hung on trunnions. There are two converters in case of accident, and each is provided with a 10-in. hydraulic crane. After the Bessemer steel has been cast into ingots it is transferred to the soaking pits, where it remains until of sufficient temperature for rolling. Each ingot is then removed by a crane to the rolling table of the blooming-mill, where it is reduced to about 7 in. square in section. From here the bloom, as it is now called, is taken to a 4-ton hammer, where it is cut into pieces of a weight sufficient to make one rail, and if they have not cooled down too much they are at once taken to the rail train and rolled out and finished. If by any chance they have become a little too cool they are passed into a regenerative furnace, which is furnished with reversing valves and works upon the Siemens principle. The rail train is a "three high" train built by the Birmingham Iron Foundry, Connecticut, and by repeated passes through the different grooves of these rolls the bloom is gradually reduced to the shape of a perfect rail. Nine boilers, 5 ft. in diameter and 16 ft. in length, and each having 100 3-in. tubes, furnish steam for the establishment. The blast for the converters is supplied by a vertical blowing engine, 31-in. steam, 46-air, by 48-stroke, the steam piston being connected directly with the blast piston. The engine has two 10-ton fly wheels. This is the only company that has Bessemer plant in New England.

Large Steel Forgings.—Sir Joseph Whitworth and Co., of Manchester, have just completed several exceptionally large steel forgings. One of these is a tube for one of the 110 breach-loading guns now being built for the Government at Elswick. This tube has a length of 42 ft. 6 in., an outside diameter of 27·1 in., and is made with a forged hole 14¾ in. diameter. The total weight of the forging as sent out of the works is 26 tons, and it is the largest gun tube ever made in this country. It is a splendid specimen of one of Sir Joseph Whitworth's specialities in hollow forging, and if it had been a solid casting it would have been over 40 tons in weight. Another large forging is a shaft for a new steamboat that is being built by Messrs. Laird and Co., of Birkenhead, for the City of Dublin Steam Packet Company, which, it is said, will be the swiftest paddle-wheel steamer ever built. The maximum outside diameter of the shaft is 30½ in., minimum 24 in., with a hole from 14 to 15 in. diameter; the throw of crank is 51 in., total length 55 ft., and total weight 48 tons This a built-up shaft, forged hollow, which reduces its weight one-third, as compared with a solid shaft, and it will be finished ready to drop into its place in the steamship. The firm has also in hand a number of other heavy cranks both for home and abroad, and they are so busy in their steel department that further extensions of this branch of their works are being carried out.

The Steam-Engine Makers' Society.—In the report for the past month, just issued, the secretary of the Steam-Engine Makers' Society expresses regret that the sanguine anticipations which were entertained a few weeks back, with regard to the prospects of an improvement in trade, have not been realised. Taking the number of unemployed as a test, the decline must have further extended. The chief centres of depression, however, continue in the shipbuilding districts. The reports from nearly all these districts continued of a depressing character, and when they knew that society men were a minority in many of the marine engineering centres of industry, their percentage of unemployed members must show that a large percentage of the working class was waiting for work. They could not, however, see that there had been any serious decline at stationary engine, locomotive, or toolworks, their returns from the above branches being much the same as in former reports, and the Lancashire branches, with the exception of those on the coast, were fairly well employed. The number of members now on the books of the Society in receipt of out of work support amounts to about 3 per cent. The report refers to an attempt made by one of the firms in the Barrow district to reduce wages, which had resulted in the men ceasing work.

THE PHILADELPHIA ELECTRICAL EXHIBITION.

The Electrical Exhibition at Philadelphia is, perhaps, all that could be desired for the study of American progress in the later developments of electricity. The failure of the Conference of Electricians, for such in point of fact it was, there being nothing worth recording in their proceedings, has in no way affected the success of the Exhibition, in which there is much that is new and interesting to European visitors. It cannot but be admitted that the Americans are ahead of us in electric lighting, and there are several machines in the Exhibition which have valuable features, and are quite unknown in Europe. That which strikes one most are the incandescent systems of Edison and of Weston, the arc systems of Thomson-Houston, Hochhausen, and Van der Poele, the multiplex telegraphy of Delany, and several telephone exchanges. In all these it is the details which often go far to make a system a success, which are most worthy of note. The building is smaller than any of those in which the European exhibitions have been held, and the blaze of light is almost overpowering. A course of lectures was commenced by Professor George Forbes, who lectured on dynamo-electric machinery. One of the most interesting exhibits is the Thomson-Houston system of lighting mainly for arc lights. The dynamo machine of Professor Elihu Thompson for sustaining 30 arc lights in series with a current of about 10 ampères weighs about 1¼ ton. It is cylindrical in its general form, being about 4 ft. long and 3 ft. in diameter or height. The armature consists of a globular shell of iron 20 in. in diameter, surrounded by three flat coils of wire wound in the manner of the coils on the cylindrical armature of a Siemens machine. The axis of rotation of the armature is at right angles to the axis of the cylinder forming the field magnets. The field magnets are constructed as follows:—Two hollow cylinders with their axes in one line, one of them on each side of the armature, have those ends close to the armature closed with an ironshell of globular form so as to envelope the armature. At the other ends the cylinders have flanges. They are wound with magnetising coils, and the magnetic circuit is completed by 18 iron bars, outside these coils, connecting the flanges of the two cylinders. As a means of producing an intense magnetisation of the armature, every physicist will see that this is a much more scientific arrangement than any of the European types, as the Gramme, Siemens, Bürgin, or the American imitations of them, such as the Edison, Weston, Maxim, or Brush. The essential principle involved is to be found in several of the American machines exhibited here besides the Thomson dynamo. In the machine I examined the field magnets had 12 layers and 1200 convolutions of wire ·128 in. diameter. The field magnets are in series with the armature, and the total internal resistance is 21½ ohms, which is one-eighth of the circuit resistance.

When we come to look at the commutator of this machine we find something quite novel. The three coils have six ends, one end from each coil are soldered together and insulated, the other three ends are connected each with one arm of the commutator, the two brushes are each doubled, and the two brushes constituting a pair are separable to a greater or less extent. The angle of separation of the two collecting brushes in each pair is regulated by a special contrivance so as to give a constant current in the circuit. With a maximum number of lamps they are at an angle of 60°, for the minimum at a angle of 90°. The regulation is produced by a set of levers connected with the armature of a horse-shoe electro-magnet and a dashpot. If the current be too strong or too weak this electro-magnet acts and adjusts the position of the brushes. A subsidiary regulator is also added. This is a relay in series with the lamp circuit, which breaks a shunt put upon the main regulator. To kill the sparks of the commutator an air blast is provided driven by rotation of the shaft. It consists of an iron disc revolving in an oval-shaped cavity in an iron case. The disc has radial slots, in which blocks of vulcanite rest. These are thrown out by centrifugal force at the elongated part of the oval, and so compress the air, which flies out along with lubricating oil on to the commutator.

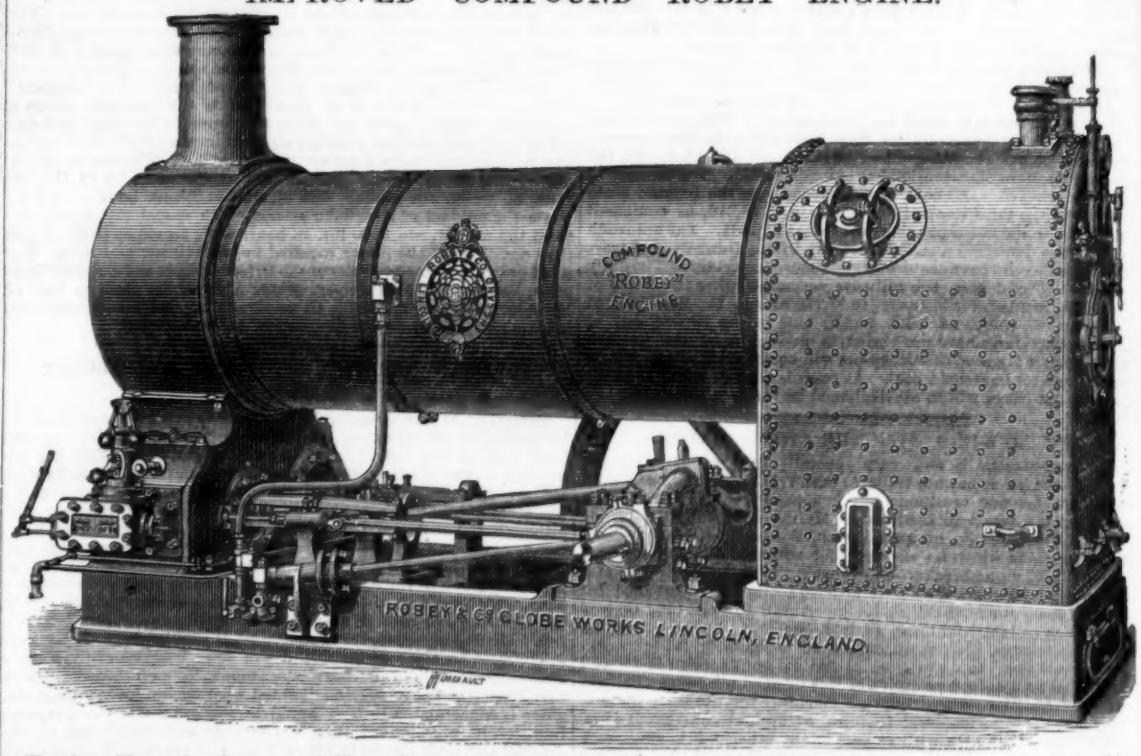
Lightning protectors are found essential for the safeguard of the dynamos. In one ingenious form, which is placed on each side of the machine, the lightning plays between the near parts of two copper horns. The arc would continue to play across this space were it not for a special device. This is a fixed magnet, which diverts the arc to the ends of the horns, where the arc is broken and cannot form again.

When two series of arc lights are arranged on parallel circuits the variations of one affect the other series, and steadiness is impossible. To prevent this the Thomson-Houston Company pass each current first through an arm of a large electro-magnet, which prevents these sudden variations of current. I believe that this is the old Blanby's coil, which used to be employed in England.

Ten incandescent lamps may be placed anywhere in circuit in place of an arc light. A regulating box is supplied with 10 resistances equivalent to the 10 lamps. Ten small electro-magnets are added to switch in a resistance automatically when a lamp is extinguished. An electro-magnet is also in place to cut out the whole set of incandescent lamps should the current accidentally rise above 11 ampères. It is, however, only for a series of arc lamps that this system will recommend itself, and it is really very efficient for this purpose, and is interesting from many advantageous arrangments. The wires are, however, generally carried overhead.

HOLLOWAY'S OINTMENT AND PILLS—SURE RELIEF.—The weak and enervated suffer severely from nervous affections when storms or electric disturbances agitate the atmosphere. Neuralgia, gouty pangs, and flying pains, very distressing to a delicate system, may be readily removed by rubbing this Ointment upon the affected part after it has been fomented with warm water. The Pills, taken occasionally in the doses prescribed by the instructions, keep the digestion in order, excite a flow of healthy bile, and regenerate the impoverished blood with richer materials, resulting from thoroughly assimilated food—wanted which, the strongest must inevitably soon sink into feebleness, and the delicate find it difficult to maintain existence. Holloway's Ointment and Pills are infallible remedies.

IMPROVED COMPOUND ROBEY ENGINE.



The above illustration shows one of Messrs. Robey and Co.'s improved compound Robey semi-fixed engines. In ordinary high pressure engines the steam after having done its work in propelling the piston to the end of its stroke is then discharged direct into the atmosphere, very often (especially in badly designed engines) at a considerable pressure, the whole of which is lost power. For many years past attempts have been made to avoid the loss by passing the exhaust steam into a second cylinder of larger diameter, and then utilising its remaining energy, and so far back as the year 1864 Messrs. Robey and Co. constructed engines on this plan. Shortly after, however, they made such great improvements in their high pressure engines, especially in the design now so well known as the Robey engine, as to make them even more economical than the compound engine as then made, so that their use was discontinued. Of late however, Messrs. Robey and Co. have made such further improvements in the construction of compound engines as to secure an economy of fuel which has never been approached by any other maker, and is rarely equalled in even the best class of condensing marine engines.

Commencing with steam of at least 120 lbs. pressure this is expanded in the two cylinders down to atmosphere pressure, being reheated on its way in an intermediate receiver of large capacity, thus avoiding the great loss between the two cylinders so often found in engines of the compound type. Another point of great importance is the proper distribution of the steam between the high and low pressure cylinders, this being often so incorrectly done that one cylinder acts as a brake upon the other, and a loss instead of saving is the result. The valve gear in the Robey engine is so arranged that this loss can never take place. The working parts are so arranged as to be easily accessible for examination and adjustment, and the whole construction has been made so strong and simple that it can be worked with the same ease as an ordinary double cylinder engine. The smaller engines are arranged to work with one slide valve to each cylinder with its cut off fixed at the best point for an average load. The larger engines—*i.e.*, 25-horse power and upwards—have independent cut off valve, worked by separate eccentrics, so that the ratio of expansion may be varied if required. All engines have improved high speed governor and equilibrium throttle valve for regulating the speed to a great nicety with great variation of load.

A series of carefully conducted tests show that the improved compound engines as made by Messrs. Robey and Co. will work with a consumption of less than 2 lbs. of Welsh coal per horse power per hour when developing 2½ times their nominal power, an economy far beyond that attained by other makers. For electric lighting, driving mills, factories, or other purposes requiring steady continuous power the Robey compound engine offers advantages of great power in small space, combined with great strength, durability, and economy.

BRITISH AND FOREIGN SAFETY FUSE COMPANY,
WORKS: REDRUTH, CORNWALL,
MANUFACTURERS OF
PATENT SAFETY FUSE FOR ALL KINDS OF BLASTING PURPOSES,
For MINING & RAILWAY OPERATIONS,
ALSO FOR
ALL KINDS OF SUBMARINE WORK.
This FUSE is made for ALL CLIMATES, and of any length and sufficient water-resisting properties to ensure ignition at any depth.
For PRICE LISTS, SAMPLES, &c., apply at the Works, or
LONDON OFFICES—3 and 4, Adelaide Place, King William Street, London Bridge, E.C.
TRADE MARK,—TRICOLOUR COTTON (Red, White, and Blue), running through the colour of Powder.

TANGYES LIMITED, CORNWALL WORKS, BIRMINGHAM.

LONDON: 35, Queen Victoria Street. **NEWCASTLE: St. Nicholas Buildings.** **MANCHESTER: Deansgate.** **GLASGOW: Argyle and Hope Streets.**

IMPROVED WESTON'S DIFFERENTIAL PULLEY BLOCKS,

Tangyes' Patent, August, 1878.

These Blocks are fitted with Tangyes' Patent Chain Guides, patented, August, 1878, which prevent the troublesome locking of chains, and enable the Blocks to be used horizontally or at any desired angle.

—

In the High Court of Justice.
Chancery Division.

TANGYE v. PRIEST.

Notice is hereby given, that a reward of TWENTY POUNDS will be paid by TANGYES LIMITED, of Cornwall Works, Smethwick, near Birmingham, to any one giving to them or their Solicitors the first information which will lead to the detection of and the granting of a similar Injunction to that in the above cause, against any other person or persons MAKING, BUYING, or SELLING Weston's Pulley Blocks having Mr. GEORGE TANGYE'S Improved Guides (patented August, 1878) or colourable imitations thereof attached thereto. Apply to Messrs. J. B. Clarke and Co., 40, Waterloo Street, Birmingham, Solicitors to Tangyes Limited.

February 27th, 1884.

REDUCED PRICES.

Tested to..... cwts.	5	10	12	20	30	40	60	80
Blocks per set	8/-	12/6	12/6	17/6	25/-	32/-	45/-	65/-
Bright Chain per ft.	5d.	5d.	6d	7d.	8d.	9d.	10d.	11d.

The length of chain required is rather more than four times height of lift.

Parts of Weston's Pulley Blocks for Repairs.

Tested to...cwts	5	10	12	20	30	40	60	80	100	120
Top Block.....	6/-	10/	10/-	15/-	20/-	24/8	36/-	51/-	8 /-	95/-
Top Sheave	2/8	3/	3/-	4/3	8/8	11/6	12/8	15/8	22/-	40/
Bottom Block...	2/8	3/3	3/8	5/-	7/-	9/-	11/-	16/3	38/-	55/-
Bottom Sheave	1/3	/1	1/3	1/3	2/	2/3	3/-	4/3	7/3	9/-

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February 27th, 1884.

With Tangyes' Gear.

Tested to	Blocks per set.	Lift Chain per foot	Hand Chain per foot
2 tons	£2 15 0	9d.	6d.
3 ,,	3 5 0	10d.	6d.
4 ,,	4 0 0	11d.	6d.
5 ,,	5 10 0	1/-	7d.
6 ,,	7 0 0	1/3	7d.
8 ,,	9 0 0	1/6	7d.
10 ,,	12 0 0	1/9	8d.

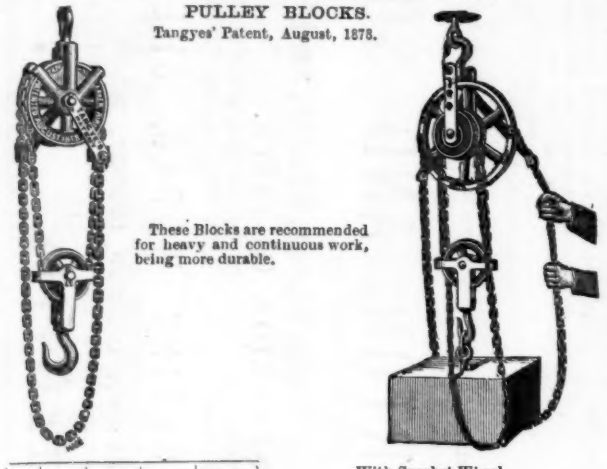
With Spocket Wheel.

Tested to	Blocks per set.	Lift Chain per foo	Hand Chain per foot
1½ tons	£1 15 0	8d.	6d.
2 ,,	2 5 0	9d.	7d.
3 ,,	3 0 0	10d.	8d.
4 ,,	3 15 0	11d.	8d.

The length of lift chain required with these Blocks is twice height of lift plus 6 ft.
,, hand ,, ,, ,, twice height of lift.

EXTRA STRONG IMPROVED WESTON'S DIFFERENTIAL PULLEY BLOCKS.

Tangyes' Patent, August, 1878.



These Blocks are recommended for heavy and continuous work, being more durable.

No.	Size.	Tested to	Blocks per set	Bright Chain per ft.
	Cwts.	Cwts.		
1	5	10	12/6	5d.
2	10	15	17/8	6d.
3	20	30	25/-	8d.
4	30	40	32/-	9d.
5	40	60	45/-	10d.
6	60	80	65/-	11d.

Length of chain required is rather more than four times height of lift.

With Spocket Wheel.

No.	Size.	Tested to	Blocks per set.	Lift Chain per ft.	Hand Chain per ft
	Cwts.	Cwts.			
10	20	30	35/-	8d.	6d
11	30	40	45/-	9d.	7d.
12	40	60	60/-	10d.	8d.
13	60	80	75/-	11d.	8d.

Length of lift chain required is twice height of lift plus 6 feet.
Hand chain twice height of lift.

CHERRY'S PATENT SELF-SUSTAINING BRAKE BLOCK.

TANGYES LIMITED, SOLE MAKERS.

The advantage this Block possesses above others is its FREEDOM FROM FRICTION. It is as frictionless as an ordinary crab, and with it a man can do at least three times as much work as with ordinary Blocks.

The Block is self-sustaining. It is fitted with Self-acting Brake. The weight can be lowered rapidly and without exertion by pulling the brake cord.

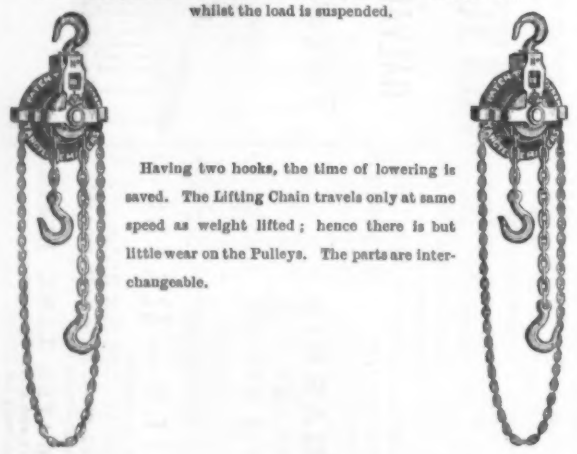
The usual method of lowering, viz., by pulling hand chain, may also be adopted.

Tested to	BLOCKS per set.	Bright Lift Chain.	Bright Hand Chain.
½ ton	£1 15 0	6d. per ft.	5d. per ft.
1 ,,	2 5 0	7d. ,,	5d. ,,
2 ,,	3 0 0	9d. ,,	7d. ,,
3 ,,	6 0 0	10d. ,,	7d. ,,
4 ,,	7 10 0	11d. ,,	7d. ,,
6 ,,	18 9 0	1/3 ,,	7d. ,,

The length of lift chain required is 3 feet more than double the height of lift.
,, ,, hand chain ,, 3 feet less ,, ,, ,,
In ordering state height of lift.

TANGYES' DOUBLE LIFT "DYNAMIC" BLOCK.

This Block possesses the invaluable quality of not "RUNNING DOWN" whilst the load is suspended.



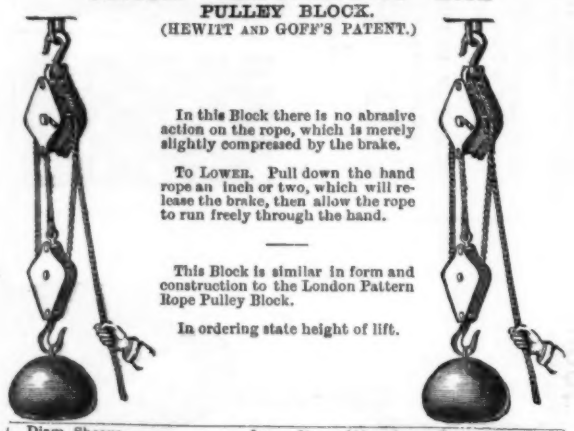
Having two hooks, the time of lowering is saved. The Lifting Chain travels only at same speed as weight lifted; hence there is but little wear on the Pulleys. The parts are interchangeable.

Tested to	Price Block.	Lift Chain, with two Hooks and Hand Chain.
5 cwts.	£0 16 0	1/6 per foot lift
10 ,,	1 4 0	2/- ,, ,,
20 ,,	1 12 0	2/3 ,, ,,
40 ,,	2 8 0	2/3 ,, ,,

In ordering, state height of lift.
In case of repairs, quote number of block and letter cast or stamped on the required part.

TANGYES' "SELF-SUSTAINING" ROPE PULLEY BLOCK.

(HEWITT AND GOFF'S PATENT.)



In this Block there is no abrasive action on the rope, which is merely slightly compressed by the brake.

To LOWER. Pull down the hand rope an inch or two, which will release the brake, then allow the rope to run freely through the hand.

—

This Block is similar in form and construction to the London Pattern Rope Pulley Block.

In ordering state height of lift.

Diam. Sheave.....Ins. Width Groove..... ,,	2½ ⅜	3⅛ ½	4 ⅝	4¾ ¾	5 ⅞	6 1
Pair 1 and 1 Sheave Blocks Best Rope per foot lift	8/8 -/2	10/- -/3½	11/8 -/4½	14/8 -/5	17/6 -/7	20/- -/10
Pair 1 and 2 Sheave Blocks Best Rope per foot lift	9/6 -/3	11/6 -/4½	13/- -/6	16/8 -/7½	21/- -/10	24/ 1/1
Pair 2 and 2 Sheave Blocks Best Rope per foot lift	10/8 -/3	13/- -/5⅛	15/- -/7	19/ -/10	25/- 1/-	27/6 1/5½
Pair 2 and 3 Sheave Blocks Best Rope per foot lift	12/- -/3½	14/6 -/6	17- -/8⅜	21/- 1/-	27/6 1/2	31/- 1/8
Pair 3 and 3 Sheave Blocks Best Rope per foot lift	13/- -/4	15/- -/7½	18/6 10/½	23/- 1/2	29/6 1/3	34/- 2/-
Pair 3 and 4 Sheave Blocks Best Rope per foot lift	14/- -/5	16/8 -/8½	20/- -/11	26/ 1/4	34/- 1/8	40/- 2/3
Pair 4 and 4 Sheave Blocks Best Rope per foot lift	15/- -/6	17/6 -/10	21/6 1/2	30/- 1/6	36/- 1/10	45/- 2/3

TANGYES' WROUGHT-IRON ROPE PULLEY BLOCKS.

(LONDON PATTERN.)

The Eye, as shown in No. 4, is supplied with the smallest Block of each pair ordered. The actual width of groove is from 1/16 to ⅛ more than list, so that the 16×3¼ is really 16×3⅜, and so on, to allow for new rope being larger.
These Blocks have turned shafts, bright pulleys, and are bored.
The Cross-heads are made of wrought-iron. All parts are interchangeable.

Dia. Sheave ...ins. Width Groove ...	2½ × ⅜	3½ × ½	4 × ⅝	4¾ × ¾	5 × ⅞	6 × 1	7 × 1¼	8 × 1½	9 × 1¾	10 × 2	11 × 2¼	12 × 2½	14 × 2¾	15 × 3	16 × 3¼
Snatch No. 1 ..... Weight .....lbs.	— —	3/9 4	4/6 5	5/3 8	7/6 11	9/- 14	11/- 21	14/ 31	21/6 44	42/- 62	50/ 91	75/- 129	95/- 152	115/ 211	145/ 249
Snatch No. 1a ... Weight .....lbs.	— —	4/6 4	5/3 6	6/6 9	8/9 11	10/3 16	12/6 23	16/ 33	24/ 46	45/- 66	60/- 93	84/- 120	105/ 164	130/- 219	180 260
1 Sheave ..... Weight .....lbs.	2/6 1	3/ 4	3/9 5	5/3 9	6/6 12	7/8 16	9/6 23	12/6 35	20/- 47	30/- 66	45/- 92	60/- 118	80/- 170	100/ 225	115/ 350
2 Sheaves ..... Weight .....lbs.	3/6 2	5/ 5	5/3 8	7/3 13	9/6 20	11/- 26	16/ 35	22/6 56	32/- 74	50/- 105	90/- 156	105/- 222	126/ 296	150/- 412	175/ 504
3 Sheaves ..... Weight .....lbs.	4/6 3	5/3 7	7/3 10	9/6 18	12/6 25	14/6 35	21/- 49	30/ 75	45/- 104	70/- 144	115/ 214	140/ 292	170/- 416	200/ 566	240/ 695
4 Sheaves ..... Weight .....lbs.	6/- 5	6/9 10	9/- 14	13/- 23	17/3 38	20/ 49	30/- 68	42/6 104	65/- 145	95/- 208	140/ 289	165/ 390	200/- 550	260/ 760	300/ 880
Spare Iron Sheaves ea.	-/3	/4	-/6	-/10	1/3	1/6	2/3	3/6	4/6	6/-	8/-	10/-	14/-	17/-	20/
Brass sheaves, ea.	1/	1/6	2/3	3/6	5/-	6/8	8/9	12/9	19/3	32/	—	—	—	—	—
Blocks will take Chain ins.	—	—	—	5/16	¼	5/16	⅜	7/16	½	9/16	⅝	11/16	¾	13/16	⅞

For Brass Sheaved Blocks, add price of Brass Sheaves, less that of Iron Sheaves.
For Galvanising these Blocks, add 20 per cent. to above prices.

TANGYES' GIN BLOCKS OR RUBBISH PULLEYS.

Diam. Pulley ..... in. Width Groove ... ,, Weight..... lbs. Price ..... each Spare Sheaves ... ,,	2½ ⅜ 1 3/- -/3	3½ ½ 1¾ 3/3 -/4	4 ⅝ 2¾ 3/6 -/6	4¾ ¾ 4¾ 4/- -/10	6 1 10½ 4/6 1/-	7 1¼ 13½ 5/- 1/3	8 1 13 5/8 1/6	9 1 14 6/- 1/9
Diam. Pulley ..... in. Width Groove ... ,, Weight..... lbs. Price ..... each Spare Sheaves ... ,,	10 1 16 6/6 2/-	11 1 18 7/8 2/3	12 1 22 8/3 2/3	14 1¼ 31 9/- 3/9	16 1½ 45 12/- 5/3	18 1½ 50 14/ 6/-	20 1¼ 58 17/- 7/6	22 1¼ 67 19/ 8/9

WROUGHT-IRON ROPE PULLEY BLOCKS.

TABLE GIVING TEST LOADS.

Diam. Sheave ins. Width Groove ,,	2½ × ⅜	3½ × ½	4 × ⅝	4¾ × ¾	5 × ⅞	6 × 1	7 × 1¼	8 × 1½	9 × 1¾	10 × 2	11 × 2½	12 × 2¾	14 × 3	15 × 3	16 × 3¼
Cwts. per Sheave	1	3	5	7	10	12	18	27	35	48	60	75	90	105	120

RULE:—

$$\frac{\text{Load}}{\text{"Test" Load per Sheave}} = \text{number of Sheaves and size of blocks.}$$

EXAMPLE:—

A pair of 3 and 3 Sheave, ⅞ in., at 10 cwt. per Sheave will test to
Or, ,, 2 3 ,, 1 ,, 12 ,, ,, 5 60 cwts.

For a slight extra charge Blocks can be tested before leaving our Works.

—

NOTE.—We do not bind ourselves to the exact powers given above, but they are approximately correct. In ordering, it is always advisable to leave a sufficient margin.

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MINING MACHINERY, MILLING MACHINERY

Of the MOST APPROVED AMERICAN PATTERNS.

GOLD MILLS.

The California pattern of Gold Stamp Mill is universally accepted as the most perfect, economic, and efficient made.

We have over 900 stamps in successful work in the various Western Gold Districts.

SILVER MILLS.

Silver amalgamation in Pans is essentially an American vstem evolved after years of work on the rich silver mines Nevada.

We have over 500 Stamps, with necessary pans, settlers, roasting furnaces, &c., all of our own manufacture, at work in different silver camps of the United States, Mexico, and South America, and Phillipine Islands, Asia.

CONCENTRATION MILLS

Of the most approved German pattern and arrangement, or with Stamps and Frue Vanner Concentrators for low grade silver ores, light in lead. We have over 20 large German pattern mills at work on lead, zinc, or copper ores, and numerous Vanner mills on ores never before successfully concentrated.

Mining Pumps, Cornish pattern, of the largest sizes. **Hoisting Engines,** from 4 h.p. up to the largest direct-acting engines to sink 3000 feet.

SMELTING WORKS.

We have 80 Water Jacket Smelting Furnaces in use from 20 in. circular up to 54 in. by 60 in. for lead and silver smelting; and special High Jacket Furnaces for copper ores.

Engines of any size, plain slide valve, Corliss, compound Corliss, Boilers, all sizes. **Leaching Mills, Hallidie Wire Rope Tramways. Comet Crusher,** with capacity of 12 to 20 tons per hour. **White, Howell. Bruckner, and Stetefeldt Roasting Furnaces, &c.**

We have had twenty years experience in the manufacture solely of MINING MACHINERY, and have special facilities for shipping to all foreign parts through our New York Office, where all details of clearance, shipment, and insurance are conducted. Our machinery is already well known in Mexico, Peru, Chili, Venezuela, Honduras, and other South American countries.

Correspondence solicited. Descriptive Circulars and Catalogues on application

FRASER AND CHALMERS.

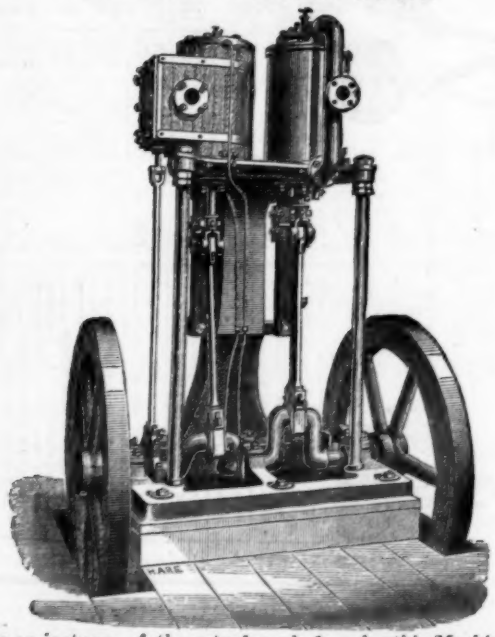
Principal Office and Works.	New York Office.
Fulton and Union Streets, Chicago, Ill, U.S.	No. 2, Wall Street, New York, U.S.

COLORADO OFFICE—CHEESMAN BLOCK, DENVER.

THE

"Champion" Rock-borer

AND AIR COMPRESSOR.



As an instance of the actual work done by this Machinery in various kinds of ground, some of it the hardest rock, it may be mentioned that in Cornwall, irrespective of the work performed by the "Champion" Rock-borers and Air-compressors purchased by various Mines, the drivage, rising, sinking, and stoping done by contract by the Proprietor with his own Machinery now amounts to over 1350 fathoms.

Several of these Air-compressors, ranging from 3½ to 12 tons in weight may be seen in constant work in the Camborne Mining District.

R. H. HARRIS,

ENGINEER,

63, QUEEN VICTORIA STREET, LONDON.

KIRKSTALL, BOWLING, AND STAFFORDSHIRE BAR IRON

RAILS—RAILS—RAILS—

New, slightly defective.

F.B. SECTION—BULL HEAD—DOUBLE HEAD—

10, 12, 14, 16, 18, 20, 24, 30, 40, 50, 60, 70, 75, 80 lb. per yard.

Sections on application to

WILLIAM FIRTH, WATER LANE, LEEDS.

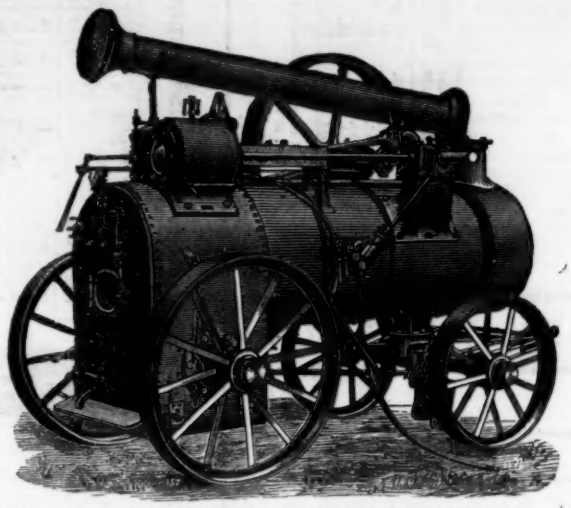
POINT and CROSSINGS with all Fittings complete.

2000 tons in stock ready for delivery.

CLAYTON AND SHUTTLEWORTH,

STAMP END WORKS, LINCOLN, AND 78, LOMBARD STREET, LONDON.

☞ *The Royal Agricultural Society of England have awarded Every First Prize to CLAYTON and SHUTTLEWORTH for Portable and other Steam Engines since* 1863, *and Prizes at every Meeting at which they have competed since* 1849.



Steam Engines, portable & fixed,

For Coals, Wood, Straw, and every kind of Fuel.

OVER 21,500 SOLD.

Thrashing Machines.

OVER 19,500 SOLD.

Straw, Corn, and Hay Elevators.

Chaff Cutters for Steam Power.

Grinding Mills.

Saw Benches.

Traction Engines, &c.

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THE ONLY GOLD MEDAL

AWARDED FOR

PORTABLE STEAM ENGINES.

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PARIS, 1855, 1867, and 1878;

VIENNA, 1857, 1866, and 1873.

Catalogues in English and all European Languages free on application.

THOMAS TURTON AND SONS,

MANUFACTURERS OF

Cast Steel for Mining and other Tools, Shear, Blister, and Spring Steel.

FILES OF SUPERIOR QUALITY.

EDGE TOOLS, HAMMERS, PICKS, AND ALL KINDS OF TOOLS FOR RAILWAYS, COLLIERIES, ENGINEERS, AND CONTRACTORS LOCOMOTIVE ENGINE, RAILWAY CARRIAGE, AND WAGON SPRINGS AND BUFFERS.

SHEAF WORKS, AND SPRING WORKS, SHEFFIELD.

LONDON OFFICES:—90, CANNON STREET, E.C.

POTENTITE.

This unrivalled Explosive, as manufactured by the **New and Perfected Machinery** of the Company, is perfectly safe for transit, storage, and use, and is employed in every description of Mining or Quarrying Work, for Tunnelling, Pit Sinking, Engineering Work, and Submarine Operations, with the most complete success and satisfaction.

Potentite does NOT contain its own MEANS OF IGNITION, is free from Nitro-Glycerine, and its SAFETY has been specially demonstrated by public experiments.

Its strength is unequalled. Its action is certain.

In action it gives off neither flame, smoke, nor offensive smell. By its use labour is economised, as work can be resumed immediately after the shot is fired.

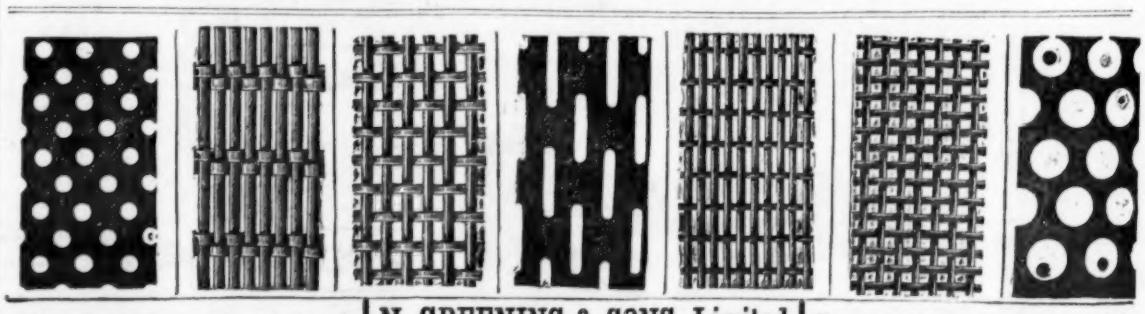
POTENTITE is specially adapted for export to hot climates, as it is unaffected by heat, and is free from dangerous exudations.

POTENTITE IS THE SAFEST STRONGEST, AND WORK FOR WORK, CHEAPEST EXPLOSIVE IN THE MARKET.

For particulars and prices, apply to—

THE POTENTITE COMPANY. LIMITED.

HEAD OFFICE—3, FENCHURCH AVENUE, LONDON, E.C.



Extra Treble Strong Wire Cloth and Perforated Metals in Steel, Iron, Copper, Brass, Zinc, Bronze.

Made in all Meshes and Widths.

N. GREENING & SONS, Limited,

Wire Manufacturers and Metal Perforators,

WARRINGTON.

Jigger Bottoms, Trommels, Cylinder Covers, Riddles, Sieves for Diamond, Gold, Silver, Copper, Lead and Tin Mines.

Samples and Prices free on application.

FRANCIS MORTON AND CO., LIMITED, LIVERPOOL,

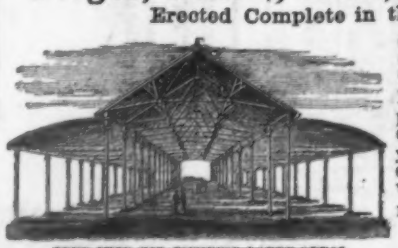
MANUFACTURERS OF

GALVANISED CORRUGATED IRON ROOFS, BUILDINGS, AND SHEDDING,

WHICH THEY HAVE EXTENSIVELY ERECTED FOR THE REQUIREMENTS OF

Forges, Rolling Mills, Puddling Sheds, Ironworks, and Collieries

Erected Complete in this Country, or prepared to Plan for Erection Abroad.



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GALVANISED OR PAINTED CORRUGATED IRON ROOFING PLATES and TILES. HEAVY CORRUGATED IRON PLATES for fireproof floors, roadways, parapets, &c. (for producing which F. M and Co. have recently laid down powerful Hydraulic Machinery). Wrought-iron Tanks, Guttering, and General Constructional Wrought Ironwork.

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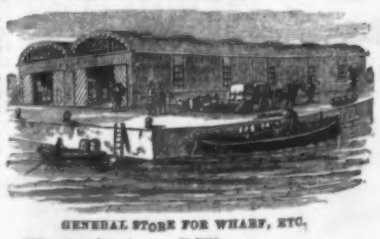


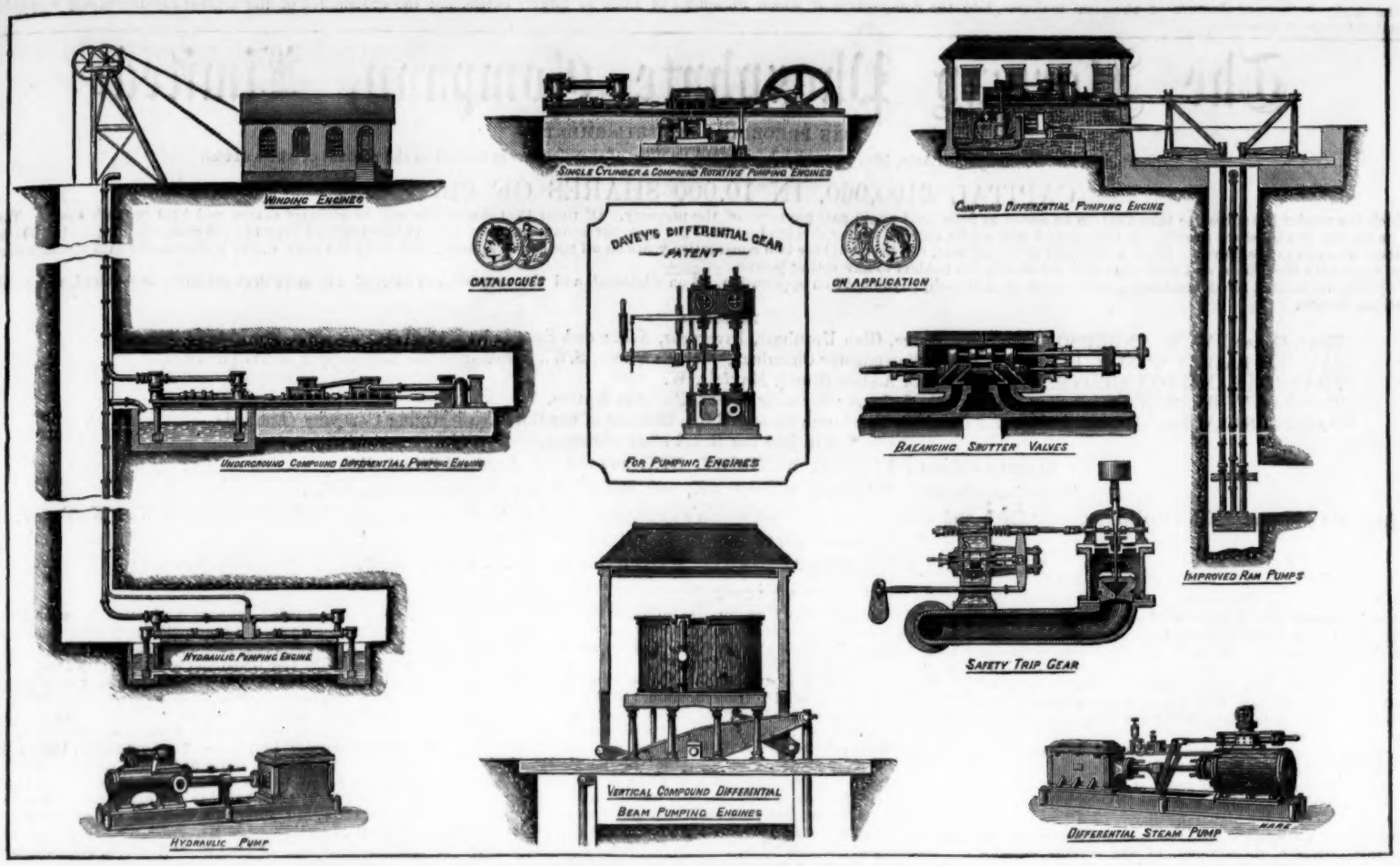
GENERAL STORE FOR WHARF, ETC.

ondon Office: 9, Victoria Chambers, Victoria Street), Westminster, S.W.

(Rooms Nos. 27 and 28, on the First Floor.

HATHORN, DAVEY & CO.,

PUMPING MACHINERY.



MINING MACHINERY.

SUN FOUNDRY, LEEDS.

BELL'S ASBESTOS.

BELL'S PATENT ASBESTOS BLOCK PACKING for High-Pressure Engines

The following testimonials refer to this Packing:—

Mona Lodge, Amlwich, Anglesey,
2nd August, 1884.

DEAR SIR,—I have much pleasure in answering your note. Bad times in mining have compelled me to try all kinds of expedients in order to effect saving; some have succeeded and some have failed, but my underground manager, Capt. Hughes, has just said to me by the telephone—"The Asbestos Packing is the best thing ever brought here."

It saves money and trouble, but like my gas purifying oxide it lasts so long that you must not expect another order from me for twelve months at least.

Yours truly,
T. F. EVANS,
Late H.M. Inspector of Metalliferous Mines.

Mr. J. Bell.

Manchester, Sheffield, and Lincolnshire Railway—Steamship Department,
Grimsby, April 10th, 1884.

DEAR SIR,—I have much pleasure in stating that after a trial of over nine months, and comparing it with other packings, I can confidently recommend your Asbestos Packing. It is especially valuable when high-pressures are employed, as in cases where other packings have perished, owing to high temperatures, your packing has invariably stood well. I have also used it with complete success when a gland has heated with other packings, and also in cases of badly scored piston rods. I consider the results I have obtained by its use for our marine engines to have been in every way highly satisfactory.

Yours truly,
G. H. CLARKE, Sup. Engineer.

Mr. J. Bell.

Department of the Director of Navy Contracts,
Admiralty, Whitehall, 20th June, 1884.

SIR,—I have to inform you that your tender has been accepted for Bell's Rolled Cloth Asbestos Packing to sample submitted:—Elastic core ... ... Square.
" " ... ... Round.

To Mr. John Bell.

JOHN COLLETT, Director of Navy Contracts.

The Patent Block Packing is square, as Fig. 1 and Figs. 2 and 3 represent the Round Block Packing with solid and hollow rubber core, and Fig. 4 without core, but with rubber inlaid. As these packings are extensively imitated, and as it is a common practice among dealers and agents to supply the cheaper manufactures at my list prices, users are requested to see that the packing supplied to them bears the trade mark.

BELL'S ASBESTOS BOILER PRESERVATIVE.—This useful mixture by absorbing the free oxygen that is in the water entirely checks pitting and corrosion. It also disintegrates incrustation so immediately as to prevent its adhering to the plates. Not only is a great economy of fuel effected by keeping boilers clean, but the risk of having the plates burned is thereby obviated. It has been computed that 1/16 in. thick of incrustation causes a waste of 15 per cent. of coal; 1/4 in., 60 per cent.; 1/2 in., 150 per cent. Thus the Preservative avoids the great risks which are inseparable from scaled plates, lengthens the life of a boiler, and covers its own cost a hundredfold by economy of fuel. It is entirely harmless, and has no injurious action on metals. It can be put into the feed tank or boiler, as may be most convenient. Sold in drums and casks bearing the Trade Mark, without which none is genuine.

BELL'S ASBESTOS YARN and SOAPSTONE PACKING for Locomotives and all Stationary Engines running at very high speed with intense friction.

Sandwell Park Colliery, Smethwick, 1st February, 1884.

To Bell's Asbestos Works.

DEAR SIRS,—I have much pleasure in stating that I have used your Asbestos Packing for the last 13 months for our large winding engines which are running night and day, and also for the fan, pumping, and hauling engines at the above Colliery, and during that period we have not used more than one-third the Packing we had formerly; and this I attribute to your Packing on account of its great durability and general excellence of quality.—I am, dear Sirs, yours faithfully,
THOMAS WINTER, Colliery Engineer.

TRADE MARK.

BELL'S ASBESTOS.

The goods of this house are of the highest quality only, and no attempt is made to compete with other manufacturers by the supply of inferior materials at low prices. All "home" orders should be sent direct to the undermentioned depôts and not through Agents or Factors.

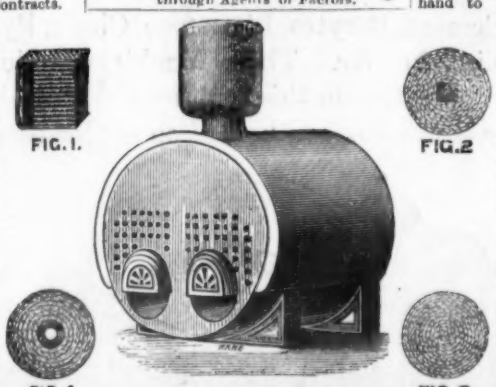


FIG. 1.

FIG. 2.

FIG. 4.

FIG. 3.

BELL'S ASBESTOS BOILER AND PIPE COVERING COMPOSITION, for coating every class of steam pipes and boilers, non-combustible and easily applied when steam is up; adheres to metals and preserves them from rust; prevents the unequal expansion and contraction of boilers exposed to weather; covers 50 per cent. more surface than any other coating, and is absolutely indestructible. It can be stripped off after many years' use, mixed up with 20 per cent. of fresh, and applied again. The composition is supplied dry, and is only to be mixed with water to the consistency required for use.

A Horizontal Boiler, 17 ft. 6 in. long, 15-H.P., gave the following results:—

Temperature on Plates - - - 156 deg.
" " Covering - - - 94 deg.

One ton of coal was saved per week, and although the fire was raked out every evening 20 lbs. of steam were found in the boiler next morning.

The following Testimonials refers to this Covering:—

Offices of the Wimbledon Local Board, Wimbledon, Nov. 28th, 1883.

DEAR SIR,—It may interest you to know that we save exactly 46 per cent. in fuel through using your covering.

Yours truly, W. SANTO CRIMP, C.E., F.G.S.

The Tamar and Kit Hill Granite Company (Limited),

Mr. John Bell, Southwark, S.E.

Gunnislake, Tavistock, 8th April, 1884.

SIR,—I have much pleasure in stating that the Asbestos covering applied by you to the boiler of our travelling crane at Kit Hill has yielded most remarkable results. Since it has been in use we have saved fully half our coals, and have effected a great saving in the time it takes to get up steam, which is often a matter of great importance to us. I should add that the crane runs on high gantries, and is fully exposed to all weather. I have formed the highest opinion of your Asbestos as used for this purpose, and as you are aware, have had another boiler similarly covered, though it has not since been used. I can most strongly recommend the material.

I am, Sir, yours faithfully, W. J. CHALK, Assoc.M.Inst.C.E., Engineer and Manager.

BELL'S ASBESTOS and INDIA-RUBBER WOVEN TAPE and SHEETING, for making every class of Steam and Water Joints. It can be bent by hand to the form required without puckering, and is especially useful in making joints of manhole and mudhole doors. It is kept in stock in rolls of 100 ft., from 1/8 in. to 3 in. wide, and any thickness from 1/16 in. upwards. Manhole covers can be lifted many times before the renewal of the jointing material is necessary. The same material is made up into sheets about 40 in. square, and each sheet bears the Trade Mark, without which none is genuine. It is very necessary to guard against imitations of this useful material, and to secure themselves against being supplied with these inferior articles at my price, users are recommended to see that every 10 ft. length of the Asbestos Tape purchased by them bears the Trade Mark.

BELL'S SPECIAL LONDON-MADE ASBESTOS MILLBOARD, for Dry Steam Joints, made of the best Asbestos fibre, is well-known for its toughness and purity, and is absolutely free from the injurious ingredients frequently used to attain an appearance of finish, regardless of the real utility of the material. Made in sheets measuring about 40 in. square, from 1-64th in. to 1 in., and 1/2 millimetre to 25 millimetres thick. Each sheet bears the Trade Mark.

The following copy of acceptance of tender refers to above:—

Department of the Director of Navy Contracts.
Admiralty, Whitehall, S.W., 17th May, 1884.

SIR,—I have to inform you that your tender for Asbestos Millboard has been accepted.—Mr. John Bell.

JOHN COLLETT, Director of Navy Contracts.

BELL'S ASBESTOS EXPANSION SHEETING (PATENT). This Sheeting is another combination of Asbestos with India-rubber, giving to the steam user the special advantages of both materials. The India-rubber Washer is protected from the action of heat and grease by an outer coating of vulcanised Asbestos Cloth, thus producing an excellent joint where expansion and contraction render other materials unserviceable. This material is admirably suited to steam pipe joints and every class of valve. Valves made of this material are very durable, as they are not subject to injury by oil.

BELL'S "ASBESTOS LUBRICANT."

"REGD"

ILLUSTRATED PRICED CATALOGUE FREE ON APPLICATION TO

BELL'S ASBESTOS WORKS, SOUTHWARK, LONDON, S. E.

OR THE DEPOTS—118a, SOUTHWARK STREET, S.E.,

Victoria Buildings, Deansgate, MANCHESTER. 11 and 13, St. Vincent Place, GLASGOW. 39, Mount Stuart Square, CARDIFF. 21, Ritter Strasse, BERLIN.

THE NORWAY PHOSPHATE COMPANY, LIMITED.

Phosphate of Lime is a mineral compound of Phosphorus, Oxygen, and Lime.
It has long been admitted that Phosphorus is a most important and essential ingredient of the brain and framework of all human and animal bodies, and is necessary to the nervous system generally.
Phosphorus is present in considerable proportions in the various plants and roots that are used for human and animal food throughout the world.
When it is reflected how much Phosphorus must be extracted from the soil every year to make the bones and tissues of all the living things that grow out of and feed upon the produce of the earth, will be seen how necessary it is that at least as much Phosphorus as is extracted from the soil should be returned to it from time to time if we would avoid its utter exhaustion.
Hence the origin of the manufacture of chemical manures, into the composition of which Phosphate of Lime so largely enters, and the explanation of the continually increasing demand for th valuable article of commerce.

The Norway Phosphate Company, Limited.

(SEE PRECEDING ADVERTISEMENT.)

Incorporated under the Companies Acts, 1862 to 1880, whereby the liability of shareholders is limited to the amount of their shares.

CAPITAL £100,000, IN 10,000 SHARES OF £10 EACH,

Of which the vendor has agreed to take 4500, to be issued as fully paid up, in part payment of the property. Of these 4500 shares, 500 will be ordinary shares, and 4000 vendor's shares. The vendo shares will be represented by share warrants to bearer, and will not be entitled to any dividend until 10 per cent. per annum has been paid on the ordinary shares of the company, *i.e.*, on the 50) referred above and those allotted to the public. When a dividend of 10 per cent. has been paid for two consecutive years on all the shares allotted, including the 4000 vendor's shares, the said vendor's shares are be placed on a par with the others, and until then will not entitle the holders to any voting power.

Subscriptions are invited for the remaining 5500 shares of £10 each, payable £1 on application, £3 on allotment, and the remainder in calls of not more than £3 each, as required, and at intervals not less than one month.

DIRECTORS.

Lieut.-General W. W. ANDERSON, Bearnock Lodge, Glen Urquhart, Inverness, N.B.; and East India United Service Club, St. James's Square, S.W.
SAMUEL BAILEY COXON, Esq., M.I.C.E., 7, Westminster Chambers, Victoria Street, S.W., Director of the Belt Copper Mines (Limited).
FRANCIS HAMILTON GROVE, Esq., 15A, South Audley Street, Mayfair, W.
THOMAS THOMPSON PYLE, Esq., M.D., J.P., 5, Lower Seymour Street, Portman Square, W.
*JOSEPH SALA, Esq. (Messrs. J. Sala and Co., 108, Fenchurch Street, E.C.), Director of the Gold Coast Mining Company (Limited).
* Will join the Board after allotment.

BANKERS—Messrs. FULLER, BANBURY, NIX, and CO., 77, Lombard Street, E.C.
SOLICITORS—Messrs. PHELPS, SIDGWICK, and BIDDLE, 18, Gresham Street, E.C.
AUDITORS—Messrs. MONKHOUSE, GODDARD, and CO., 28 and 29, St. Swithin's Lane, E.C.; and at Newcastle-on-Tyne, Middlesborough, and West Hartlepool.
SECRETARY (pro tem).—H. C. PHILPOTT, Esq.
TEMPORARY OFFICES—61, MOORGATE STREET, E.C.

The Company is formed for the purpose of purchasing and working certain Mining rights of Phosphate of Lime on the Haukedal property, which contains numerous beds of Phosphate of Lime, situated between Stadhelle and Kragero, about 20 miles from the latter place, in the district of Bamble, Province of Bratsberg, on the south-east coast of Norway, and immediately adjoining the famous Oedergarden Phosphate Mines, which are being worked with great profit by a French company.

From the enclosed extracts of the report of Percy Tarbutt, Esq., M.E., it will be seen that there are within the limits of the property, which embraces an area of 60 acres, at least nine distinct beds of Phosphate already discovered, and that the character of the Phosphate they contain is of the highest quality.

The analyses by Dr. Voelcker, F.R.S., Consulting Chemist to the Royal Agricultural Society of England, of the several samples submitted to him, give the following results:—No. 1, 80·25 per cent.; No. 2, 89·13 per cent.; No. 3, 89·96 per cent. of Tribasic Phosphate of Lime; and he appends to his analyses the following statement:—"They are very high-class Phosphates, remarkably free from iron, Alumina, and Carbonate of Lime. These Phosphates are very hard, but at the same time they are brittle, and are reduced to fine powder much more readily than many of the tougher varieties of Phosphate, such as Spanish."

The extraordinarily rapid development of the manufacture of artificial manures, of which Phosphate of Lime forms the principal ingredient, has given a powerful impetus to the search for this Mineral in all parts of the world, and large quantities are annually imported into this country from America, Canada, Spain, France, and some of the West India Islands.

The percentage of Phosphate of Lime contained in the Mineral from these different sources varies from about 40 to 70 per cent., and many of them contain large quantities of Iron, Alumina, and other deleterious constituents which detract from their value. It may confidently be stated that the Norway Phosphates from Bamble are amongst the richest and purest yet discovered in quantity in any part of the world. The Directors are informed that the exports from the French company's Mines for the year 1882 amounted to 16,000 tons, a large proportion of which averaged 90 per cent., and yielded returns of about £110,000.

It is obvious that if it is profitable to import comparatively inferior Phosphates from Canada, from Sombrero in the West Indies, and from the Islands on the Coast of South America, it must be much more so to bring 80 to 90 per cent. Mineral from a part of Norway which is within three days' sail of England.

Samples of the Phosphate, and the results of Dr. Voelcker's analyses, were submitted by Mr. Tarbutt to one of the leading firms of Phosphate brokers in London, who stated that for this high-class Mineral there is practically an unlimited market, and that the value of No. 1 sample was £6 per ton, and that of No. 3 £7 17s. 6d. per ton.

The property is situated only about two miles from the coast, and the Phosphate can be transported thither by means of a wire tramway at a merely nominal cost, as is now being done by the neighbouring French company. The cost of freight from the mines to England may thus be taken at 10s. per ton, and if the output amounts to only one-half of that of the French company, as stated above, it has been calculated that an allowance of £1 10s. per ton for mining, sorting, and other expenses, will be ample. This will bring the total cost of such an output to about £2 per ton, which will leave a profit of from £2 10s. to £5 per ton, according to the analyses and the fluctuations of the market.

The purchase price to be paid for the mining rights is £15,000 in cash, and 4500 fully paid-up shares of this company, the vendor undertaking to defray all the expenses connected with the formation of the company up to the date of allotment, except brokerage charges. Of the 4500 shares to be allotted to the vendor, 4000 are to be called vendor's shares, and are to receive no dividend until 10 per cent. per annum has been paid on the ordinary shares of the company; any balance of profit available and appropriated for dividend after that payment will be applied, first in payment, so far as it will go, of a similar dividend on the vendor's shares, and any excess will be divided, without distinction, between all the share but when 10 per cent. has been paid for two consecutive years on t total amount issued, the 4000 vendor's shares will thenceforth ra *pari passu* with the remainder of the capital, and until then w carry no voting power. No payment in either cash or shares will made on account of the purchase-consideration until the title adduced to the satisfaction of the company's legal advisers.

The following contracts have been entered into, viz.:—Thr dated respectively 15th June, 7th September, 1883, and 17th M 1884, between François Boyer of the one part, and Joseph Evison, trustee on behalf of the company, of the other part; and anothe dated 19th May, 1883, between the said François Boyer of the o part, and Edward Mammatt Gregory of the other part. The documents, together with Mr. Tarbutt's report and copies of t Memorandum and Articles of Association, can be inspected at t offices of the company's solicitors.

Full prospectuses and forms of application may be obtained fro the principal local stockbrokers, or will be forwarded by post o written application to the secretary. They may also be had (London) from the bankers, or at the temporary offices of the com pany, where intending investors are invited to call and view th samples of Phosphate, and where any further information may b obtained.

THE NORWAY PHOSPHATE COMPAN (LIMITED).

The adjoining property has been worked with great success fo more than seven years, and has made the fortunes of its owner It has recently earned profits equal to 50 per cent. per annum on capital of £160,000. The workings of the principal vein, whic commenced on surface indications of less than 1 in. wide, have bee carried to a depth of over 1100 ft., and it is stated that the vei which has been continually increasing to over 14 ft. in width better and richer at that depth than at any point above.

THE BLAKE-MARSDEN NEW PATENT IMPROVED STONE BREAKERS AND ORE CRUSHERS.

ORIGINAL PATENTEE AND ONLY MAKER.

H. R. MARSDEN,

ALSO PATENTEE AND ONLY MAKER OF THE

NEW PATENT FINE CRUSHER OR PULVERIZER,

FOR REDUCING TO AN IMPALPABLE POWDER, OR ANY DEGREE OF FINENESS REQUIRED,

GOLD QUARTZ, SILVER, COPPER, TIN, ZINC, LEAD

AND ORES OF EVERY DESCRIPTION

PATENT REVERSIBLE CUBING and CRUSHING JAWS, IN FOUR SECTIONS,

WITH PATENT FACED BACKS, REQUIRING NO WHITE METAL IN FIXING.

CRUCIBLE CAST-STEEL CONNECTING RODS. RENEWABLE TOGGLE CUSHIONS, &c.

OVER **4000** IN USE.

EXTRACTS FROM TESTIMONIALS.
PULVERIZER.

"I have great pleasure in bearing testimony to the merits and capabilities of your patent combined fine crusher and sieving apparatus. I have tried it on a variety of ores and minerals, and it pulverizes them with equal success. You can put in a small paving stone and bring it out like flour."

"In reply to your favour, I have much pleasure in informing you that the 12×3 Pulverizer we had from you is giving us every satisfaction. The material we are operating on is an exceptionally hard one. I am well satisfied with its working."

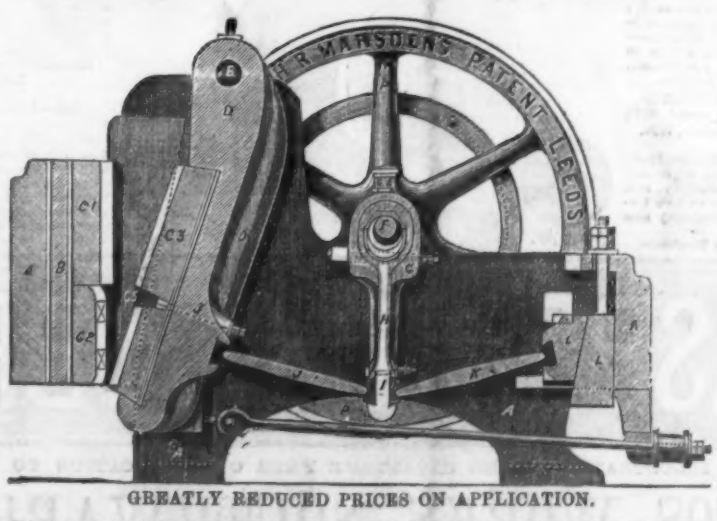
"Our experience is that the motion and mechanical arrangements of your machine are the best for pulverising that we have ever met with."

"The reports from our mines as regards the working of your Fine Crusher (30×5) recently supplied are very favourable, although we cannot quote you exact figures. On being got into position it was tried *by hand*, with the result that it made short work of the biggest pieces of ore we put into the hopper. You might say how long you would take to deliver another of the same size."

"As I once before stated, your machine is a perfect pulverizer."

"I am sure the machine will be a success, and a great one, and there is any amount of demand for such a machine. We can work it with 20 lbs. of steam, and our engine, which is a 12-h.p., plays with the work, in fact we run the Stonebreaker and the Pulverizer both together with 35 lbs."

Also Cement, Barytes, Limestone, Chalk, Pyrites, Coprolite, &c., &c. These Machines are in successful operation in this country and abroad, and reference to users can be had on application.



GREATLY REDUCED PRICES ON APPLICATION.

AWARDED OVER

60

FIRST-CLASS GOLD AND SILVER MEDALS.

ADOPTED BY THE PRINCIPAL CORPORATIONS, CONTRACTORS, MINING COMPANIES, &c., IN ALL PARTS OF THE WORLD.

ROAD METAL BROKEN EQUAL TO HAND, AT ONE-TENTH THE COST.

EXTRACTS FROM TESTIMONIALS.—STONEBREAKER.

"I now order Three of your Stone Crushers, size 15×10, to be of your very best construction, and to include two extra sets of Jaws and Cheeks for each. The last two 24×13 machines you sent me, which are at work in this colony, are doing very well. You will soon find that the railway contractors will adopt your machines in preference to the colonial ones—two of which I have. I know other contractors have had as many as nine of them, which have not given very good satisfaction. Once they know of yours thoroughly, I believe you will do a good trade with the colonies. For reference of the high character of your constructions you can refer to me as having used them with the very best results, both in New Zealand and this colony, and much prefer them to the colonial article, both in point of construction and less liability to go out of order. The material we are crushing is very hard blue stone, for railway ballast purposes. Push on with the order as quickly as possible; I do not think it necessary to have any engineering inspection. I have brought your machines prominently under the notice of all large contractors in this colony, likewise the Government. Many of the contractors have spoken to me in reference to their capabilities, and I could only tell them that they are by far and away the best and most economical I ever used. The very fact of me having purchased now Eleven from you at various intervals and various sizes, and two above 12 years ago, and having tried all the other makers, is sufficient guarantee of the capabilities and the working of your machines. Yours in every way surpass all others."

"Some of your testimonials do not give your machines half their due. I have seen men hammering away on a big rock for a quarter of a day which your machine would reduce to the required size in a quarter of a minute. I would guarantee that your largest size machine would reduce more of the Cornish tin capels (which is the hardest rock of England) in a day than 200 men, and at 1-25th the cost."

FOR CATALOGUES, TESTIMONIALS, &c., APPLY TO THE SOLE MAKER,

H. R. MARSDEN, SOHO FOUNDRY, LEEDS.

Printed by RICHARD MIDDLETON, and Published by HENRY ENGLISH (the Proprietors), at their Offices, 26, FLEET STREET, where all communications are requested to be addressed.—*October 4, 1884.*